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on

HIGHWAY TOLL

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U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

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PUBLIC HEALTH SERVICE

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BROSS, IRWIN D. J. (Roswell Park Memorial Institute): *How to cut the highway toll in half in the next 10 years. Public Health Reports, Vol. 75, July 1960, pp. 573-581.*

A large-scale, coordinated scientific attack on automobile accidents is envisaged as comprising seven steps. The first three steps described are the collection of adequate data, formulation of the conceptual picture of the chain of events leading to trauma, and the testing of this theory against the facts. The next three steps involve consideration of ways to modify the event-chain, translation into specific design changes (hardware), and putting the hardware on the production line. The seventh step, especially stressed, is the evaluation of the on-the-

highway effectiveness of the hardware. The need for this step is illustrated by data which show that present door locks, though an improvement over their predecessors, fail under rollover conditions. Other design changes to control crash injuries are discussed briefly. On the basis of data from the Auto Crash Injury Program of Cornell University, it is argued that a reasonable target for 1970 is a 50 percent reduction in the toll of death and serious injury to occupants of cars involved in highway accidents.

COMSTOCK, G.W., and SHAW, L. W. (Public Health Service): *Controlled trial of BCG vaccination in a school population—Tuberculosis studies in Muscogee County, Ga. Public Health Reports, Vol. 75, July 1960, pp. 583-594.*

In April 1947, a controlled trial of BCG vaccination was initiated in the school population of Muscogee County, Ga. Tuberculin tests with 5 T.U. of PPD were completed for 11,262 children. Non-reactors were tested with 100 T.U., and nonreactors to both doses were divided into two similar groups, one vaccinated with BCG and the other left unvaccinated as controls.

In the ensuing 12 years, there were only 35 definite cases of tuberculosis, 24 among 5-T.U. reactors, 2 among 5-T.U. nonreactors who were not tested with 100 T.U., 5 among 100-T.U. reactors, and 2 each among controls and vaccinees.

The average annual case rate for

5-T.U. reactors was 134 per 100,000; for nonreactors it was only 9 per 100,000. For both controls and vaccinees, the rate was 7 per 100,000. In this area of low tuberculosis infection rates, it was not possible to demonstrate any benefit from BCG vaccination.

There was a marked correlation of the tuberculosis case rate with size of reaction to the 5-T.U. dose, ranging from 8 per 100,000 among those with no induration to 199 among those with 10 millimeters or more of induration. The latter group comprised only 7 percent of the study population, but supplied 80 percent of the cases during the first 5 years of observation.

PARK, WILFORD E., and MOE, MILDRED I. (Minneapolis Health Department): *Rehabilitation care in nursing homes. Public Health Reports, Vol. 75, July 1960, pp. 605-613.*

During a 1-year demonstration of rehabilitation nursing conducted by the Minneapolis Health Department in 1958-59, intensive rehabilitation nursing techniques were taught to the nurses and nurses' aides in 12 nursing homes and were applied to 78 patients in these homes.

At the end of the study, the condition of the patients who had received intensive care was compared with the condition of 71 control patients in 13 other nursing homes.

In the participating homes, there was marked improvement in the morale of both patients and staff, keen competition among the homes, and general improvement in facilities, nursing staffs, and administration.

The demonstration highlighted the effectiveness of rehabilitation nursing applied by nurses and aides with the approval of the attending physicians, even in the absence of physical therapy, and on a segment of the chronically ill population whose prospects for improvement admittedly are poor.

Grants and Fellowships for Research in Nursing

Since 1955, when the Nursing Research Grants and Fellowships Branch was established within the Division of Nursing Resources, 80 grants have been awarded by the Public Health Service for extramural nursing research, representing a national investment of \$3¼ million to improve patient care. In addition, 80 nurses have received full-time fellowships for research training and more than 100 have received part-time awards. Investment to improve the research skills of nurses has exceeded a half-million dollars.

Extramural nursing studies supported thus far relate to all facets of nursing practice, as well as to nursing education, interpersonal relationships affecting patient welfare, and administration of nursing services.

Nursing research is multidisciplinary. A good half of the principal investigators have been nurses, while social scientists have run a strong second. The roster of principal investigators includes also physicians, educators, engineers, and hospital administrators.

Responsibility for the nursing research grants and fellowships program is shared by the Division of Nursing Resources, Bureau of Medical Services, and the Division of General Medical Sciences, National Institutes of Health. The consultative services of the Research Grants and Fellowships Branch, Division of Nursing Resources, are in continuous demand throughout the country. Consultation has been provided on kinds of research needed and on formulation of research projects. Also, effort is made to locate qualified potential research investigators and facilities for research training. The Division of General Medical Sciences administers the grant funds.

Applications for nursing research grants are considered first by the National Institutes of Health Nursing Research Study Section and then by the National Advisory Health Council. Following recommendation by the council, the Surgeon General makes awards. Deciding factors in selection of investigators are quali-

fications for independent inquiry, significance of inquiry, soundness of research plan, and adequacy of research facilities at the project site.

Nurse research fellowships prepare nurses to participate in research or to stimulate and guide research in nursing. In the shared responsibility for nurse research fellowships, the Division of Nursing Resources sets guidelines for the support of research training. The Division of General Medical Sciences arranges for fellowship application review by the Public Health Service's Nurse Research Fellowship Board and administers the fellowship funds.

All full-time nurse fellowships at present are special predoctoral fellowships, with stipends set according to individual estimate of living and educational expenses. Both men and women are eligible for stipends. The average age of fellows at this time is 39.

Of the 40 fellows now enrolled in 19 different universities, half are majoring in the behavioral and social sciences, a third in education, and a number of others in biological and physical science.

The Surgeon General awards fellowships for research training upon the recommendation of the Nurse Research Fellowship Board. Selection of candidates is made on the basis of their background and career plans, their depth of research interest, and their demonstrated potential for independent investigation.

Nurses who are enrolled full time in university programs and who are interested in part-time awards for research activity should be referred directly to the deans of their schools.

Other applications, either for research grants or for special predoctoral fellowships in nursing research, should be directed to the Division of Nursing Resources, Public Health Service, U.S. Department of Health, Education, and Welfare, Washington 25, D.C.—*APOLLONIA O. ADAMS, R.N., M.A., chief, Division of Nursing Resources, Public Health Service.*

How To Cut the Highway Toll in Half in the Next Ten Years

IRWIN D. J. BROSS, Ph.D.

Dr. Bross, chief of the department of statistics, Roswell Park Memorial Institute, Buffalo, N.Y., presents his paper on highway accidents in question and answer form with the express purpose of improving communication with the general reader and of giving a broad picture of the current highway accident situation unobscured by too much detail.

Q. Do you really think that the highway accident toll can be cut in half in the next 10 years?

A. I believe that it is technically feasible to do so. But let me make one point clear—I will be talking about the toll of deaths and serious injuries sustained by the occupants of cars in highway accidents. This toll can be drastically cut even if there is no reduction in the total number of accidents, or even in the total number of injuries. In other words, the highway accidents would still occur, but the occupants would tend to suffer minor or moderate injuries rather than serious or fatal injuries.

Q. What do you mean by technically feasible?

A. Cutting the highway toll in half in 10 years is a realistic target for the large-scale, coordinated scientific attack on the automobile accident problem that I will outline here. The strategy, tactics (techniques), and data for this attack are all developed, tested, and ready to go. The target could be achieved without any remarkable new scientific or technological advances; without revolutionary changes in our cars, highways, or traffic control systems; and without “reforming” the behavior patterns of drivers. In short, I am not serving up a slice

of “pie-in-the-sky.” At the same time, the scientific program is not a “pianola.”

Q. What does that mean?

A. The scientific program won’t “play itself”—it will require the wholehearted cooperation of the groups with a big stake in the auto accident problem—the automobile manufacturers, legislators, law enforcement agencies, safety groups, scientists, and, of course, the general public. Getting this cooperation is something more than a technical problem. I think that if the public realized how close we are to a major reduction in the highway toll, the cooperation would be forthcoming. Each year of delay in putting our new knowledge to use costs us thousands of unnecessary deaths and serious injuries on our highways.

Q. Why is this cooperation so essential?

A. The simplest way for me to answer this question is to outline the broad strategy of a scientific attack on the accident problem. There are seven steps in going from the scientific investigation of actual highway accidents to the eventual reduction in the death rates. I will list the steps and then go back to discuss each one:

Step 1. Collect a massive series of detailed, scientific reports on the accident circumstances and resulting injuries of persons involved in highway accidents.

Step 2. Formulate a clear conceptual picture of the chain of events that leads to the trauma in the accidents.

Step 3. Test the theory of step 2 against the facts of step 1. If the theory fails to fit the facts, go back and try again.

Step 4. Once the event-chain is established, consider ways in which the undesirable event-chain can be broken or modified by preventive measures. Estimate the potential savings in lives or reduced degree of injury so as to establish the relative importance of preventive measures.

Step 5. Translate the preventive measures into specific design changes, commonly called "hardware." This step usually entails moving from the field (that is, highway investigations) into the laboratory (the engineering studies). The hardware would be tested in the laboratory under simulated field conditions.

Step 6. Incorporate the specific design changes into the production line—put the hardware on American cars.

Step 7. Evaluate the effectiveness of the design changes. This entails moving out of the laboratory and back into the field. In other words, we must determine how well the hardware works in actual highway accidents. If the hardware doesn't do its job, then it's back to the drawing boards. The acid test is the actual reduction in deaths and serious injuries on the highway.

Q. Is this a new strategy you have presented?

A. Yes and no. In principle this is the same strategic approach which has been so successful in the past in eradicating the infectious diseases or bringing them under control. In other words, these steps can be regarded as an application of the epidemiological approach to the problem of automobile accidents. In practice, this is a new approach. In fact it is only within the last few years that the first step was taken, and only in the past few months that the process has gone all the way through to step 7. But going back to your previous question: Close cooperation between the various groups with an interest in the accident problem is needed in all of the steps and particularly in step 6. Until this step is taken, scientific knowledge cannot actually save lives on the highway.

Q. So it is up to the automobile manufacturers to put the "hardware" on the cars?

A. Not just the manufacturers. They are in a highly competitive situation where minor price or styling changes might make a big dif-

ference in sales. Legislation and public support are needed to protect the manufacturer who is willing to give safety priority over styling and sales appeal.

The "Horse Shoe Nail" Story

Q. Let's get down to brass tacks. Can you give an actual example of how this strategy was used?

A. I'd be glad to. Let me tell you a story that might be called "The Horse Shoe Nail." For want of a nail a kingdom was lost—for want of a quarter inch of steel, some 15,000 lives have been lost in the past 5 years. The story starts with the first step in the strategy, the development of the factfinding system of the Cornell Automotive Crash Injury Research Program (ACIR). The basic ACIR sample consists of tens of thousands of case histories of occupants in injury-producing rural highway accidents. An occupant comes into the sample if (a) the accident occurs in a designated sample unit, (b) it is investigated by State troopers, and (c) someone in the car is injured. The trooper fills out a detailed report of the accident circumstances, such as the speed, accident configuration, seated position of the occupants, and so on. He also takes photographs of the car. The attending physician fills out a medical report on the nature and degree of the injury. The ACIR staff receives these field reports and processes them. The processing consists of collating the reports on a given person, checking the reports for errors or omissions, analyzing these reports, and putting the information on punchcards.

The ACIR factfinding system has provided information which is adequate, both in quality and quantity, for a genuine scientific study of the accident injury problem. The success of its program is due to the fine cooperation of the law enforcement agencies and medical societies in a dozen different States and also, of course, to the individual doctors, troopers, and others who take part in this program.

Q. Why do you place so much stress on the factfinding system?

A. For one thing, it plays a key role in all subsequent steps; for another, the lack of progress toward a solution of the crash injury prob-

lem in the past generation—the failure to make any appreciable dent in the death rates—is due, to a considerable extent, to a lack of cold, hard facts. You cannot base an effective safety program on slogans, scapegoats, and suppositions. In the days of the plagues, it was believed that disease was a punishment for sins and heresy. But exhorting sinners or burning heretics didn't stop the plagues. Nowadays the highway plague is blamed on the sins of the driver. But exhorting people to drive carefully or cracking down on "crazy mixed up kids" hasn't cut down the death rates. We need an approach that starts with solid facts.

Q. But isn't the driver responsible for deaths and injuries?

A. The driver may be responsible for the accident—for setting the stage—but once the accident starts, driver behavior has little influence on the event-chain that leads to the injuries. After the accident starts, psychology leaves off, and physics and biology take over.

Q. You have referred several times to event-chains. Could you give an example?

A. Gladly. First let me set the stage. Let us suppose that we are watching a car that is traveling 50 miles an hour down a ditched, high-crown rural highway. For some reason—an oncoming vehicle, a crate in the road, a misjudgment—the driver veers on to the narrow shoulder and the car starts to roll. Our event-chain starts the instant before the occupant, say the driver, begins to move relative to car structure—say his seat.

Q. Does this type of accident happen very often?

A. Rollover is a common rural highway accident. About one-fifth of the occupants in the ACIR sample are in rollovers. Now, when the car begins to roll, two things happen simultaneously. In a typical event-chain the occupant starts moving toward the door due to the centrifugal forces. At the same time, the frame of the car is deformed or twisted. This deformation of the frame disengages the door lock and the door pops open. Next the driver is thrown through the open door: he is ejected. He then follows a trajectory through the air. Up to this point in the event-chain, it is quite possible that the driver has not sustained any injury.

Q. In other words, the injury will depend on what he hits and how he hits it?

A. Yes. If he lands head first on concrete he is likely to sustain a fatal skull fracture. If he happens to land just right on a patch of grass, he may not be hurt at all. This brings up a useful conceptual device: the probability event-chain. In a given case history, there is a single chain of events, but when we consider a series of individuals we find a branching process. In other words, if we have a set of occupants with the same event-chains up to a given point, we find that beyond this point the chains branch off and lead to different degrees and types of injuries. By means of design changes we may be able to prevent some of the event-chains that terminate in death or serious injuries.

Q. How so?

A. Well, let's go back to the point in the roll-over event-chain where the frame twists and the door lock disengages. If the door lock does not disengage, the door stays closed, the occupant stays inside of the car, and we get a very different event-chain. An extra quarter of an inch of steel in a bolt-action door lock would probably hold the door closed. In this way a design change can modify the chain of events in any automobile accident. When we change the event-chain, we also change the injury picture for better or for worse.

Q. Then the question is: Will the occupant be better off inside than outside of the car?

A. Yes, and if we define "better off" a bit more precisely we can now proceed to formulate a scientific hypothesis (step 2) and test it (step 3). For example, if by "better off" we mean a lower risk of death, our hypothesis might be: The risk of death is higher for an ejectee than for a nonejectee in a rollover accident. When we compare the observed risk of death for ejectee and nonejectee in the ACIR data, we find that for occupants ejected through doors in a rollover accident the risk of death is 0.141, or about 1 chance in 10. For nonejectee occupants the risk of death is 0.008, or about 1 chance in 100. The ejectees have roughly 17 times as large a chance of sustaining a fatal injury! Of course, we have only considered deaths and not the full injury scale.

Q. What happens if the full injury scale is considered?

A. One way to deal with the full scale is to use a technique called ridity analysis and to frame the hypothesis in a somewhat different form. Here we would want to estimate the chance that an ejectee will sustain a higher degree of injury than a nonejectee in corresponding accident circumstances, in this case rollover accidents. From the ACIR data we would estimate that the chances are about three to one that the ejectee will sustain a higher degree of injury. Either way it is plain that odds are heavily against the ejectee.

Q. Did you have a special reason for using rollover accidents as an example?

A. Yes, I did. In rollovers, a single factor, ejection, dominates the picture and this simplifies matters. At the same time, rollover accidents are the heart of the ejection problem; about half of the fatally injured ejectees in the ACIR sample were in rollover accidents.

Q. But what about other types of accidents? Might we not want the doors to come open in these accidents?

A. We can proceed for other accident configurations along the same lines as for rollover.

The results for death rates and ridity analysis are given in table 1. You will note that the odds are consistently against the ejectee. However, the advantage enjoyed by the nonejectee tends to be less than the advantage in rollover accidents. Also, in some accident configurations, such as head-on collisions, ejection plays a minor role.

Q. Isn't it possible that the seeming advantage of nonejectees merely reflects the fact that ejection tends to occur at higher speeds—where the risks are higher anyway?

A. Table 2 shows what happens when the data are tabulated by the applicable impact speed. You will note that within each of the four speed categories, the odds are against the ejectee. In the same table, you can also see the results of a tabulation by seated position of the occupants.

Q. What would happen if you were to consider all three factors—configuration, speed, and seated position—at the same time instead of one at a time as in your tables?

A. This leads to $4 \times 5 \times 9 = 180$ different accident circumstances and in this fine cross tabulation we often are left with relatively few cases in a given cross category. Subject to

Table 1. Risks of ejected and nonejected occupants in nine accident configurations

Accident configuration	Deaths only			Full injury scale (ridits)	
	Estimated risk of death		Relative risk of ejectees	Estimated probability that ejectee is worse off	Approximate odds that ejectee is worse off
	Ejectees	Nonejectees			
<i>Nonrollover: 2 cars</i>					
I. Head-on collision -----	0. 333	0. 107	(¹)	0. 745	(¹)
II. Broadside (impact on passenger compartment) -----	. 086	. 033	3	. 726	2: 1
III. Overtake: trailing car -----	. 000	. 010	(¹)	. 697	(¹)
IV. Overtake: leading car -----	. 039	. 002	20	. 652	2: 1
V. All others (fender-fender, etc.) -----	. 120	. 020	6	. 699	2: 1
<i>Nonrollover: 1 car</i>					
VI. Collision with immovable object -----	. 100	. 037	3	. 642	2: 1
VII. Collision with movable or partly movable object -----	. 076	. 008	9	. 708	2: 1
<i>Rollover</i>					
VIII. Principal -----	. 141	. 008	17	. 759	3: 1
IX. Secondary (with impact) -----	. 106	. 022	5	. 666	2: 1

¹ Less than 10 ejectees (too few for reliable estimates).

Table 2. Risks of ejected and nonejected occupants at four applicable impact speeds and in five seated positions

Impact speed of car and seated position of occupants	Deaths only		Full injury scale (ridits)		
	Estimated risk of death		Relative risk of ejectees	Estimated probability that ejectee is worse off	Approximate odds that ejectee is worse off
	Ejectees	Nonejectees			
<i>Applicable impact speed (m.p.h.)</i>					
0-19	0.018	0.004	5	0.708	2:1
20-39	.035	.007	5	.678	2:1
40-59	.099	.026	4	.673	2:1
60+	.211	.096	2	.669	2:1
<i>Seated position</i>					
Driver alone	.156	.043	4	.631	2:1
Driver with passenger	.113	.019	6	.747	3:1
Center front	.061	.014	4	.643	2:1
Right front	.110	.032	3	.662	2:1
Rear	.113	.010	11	.740	3:1

this qualification, I can say that we did not find a significant advantage to the ejectee in any of the 180 circumstances.

Q. Would you say, then, that it is always better to stay inside the car?

A. No, there are doubtless some circumstances where it would be better to be ejected. However, these circumstances are quite rare. To sum up, then, we have a massive weight of evidence in favor of keeping the occupant inside of the car. Since most ejection takes place through car doors and since the door lock mechanism determines whether or not the doors stay closed, we are led to specific design change—a better door lock. We are now in step 4 of the scientific process. Let me postpone the last part of step 4—estimation of the lifesaving potential of the door locks—so as to get on with the rest of the process.

Q. But I thought that the new cars were equipped with improved door locks.

A. After the ACIR report on ejection, the automobile manufacturers undertook step 5 of the process. I shall not go into detail on step 5 since this phase is primarily an engineering operation. Suffice it to say that the engineers developed a modified version of the original door lock and that this modification performed well under the simulated accident conditions of the testing labs. Modified door locks have been installed on nearly all American cars manufactured after 1955—thus step 6 was taken. There

remained only an on-the-highway evaluation of the modified door locks—step 7.

Q. But you've said that the locks were tested in the laboratory. Why was it necessary to test them on the highway?

A. Quite a few devices and techniques that work nicely in the laboratory fail under actual field conditions. In fact, this is what happened with the modified door locks. They were better than their predecessors, but their performance was disappointing in rollover accidents, which, as we've seen, are the heart of the ejection problem. There was only about a 25 percent improvement in the holding of door locks in rollover accidents.

Q. Why wasn't this weakness discovered in the laboratory tests?

A. I can't give a definite answer on this. However, there are two likely explanations. First, rollover force conditions are not easily simulated in a laboratory. Second, the hard-top styling trend—which came in about the same time as the modified door locks—weakened the top support and hence permitted greater deformation of the frame in a rollover. This tended to cancel out the improvement in the lock. Incidentally, this example points up the need for better cooperation between laboratory and field scientists.

Q. So after going through all seven steps, not much was accomplished after all.

A. Not this time—but I don't think that we

have reached the end of this "Horse Shoe Nail" story. After all, if we can package two monkeys to survive a free fall from outer space, we ought to be able to package the occupants of a car to survive the force conditions in a rollover accident. An extra quarter of an inch of steel in a bolt-action door lock could give a happy ending to the story.

Q. Isn't that something of an alibi?

A. I don't think so. I do not deny that the modified door locks failed to hold the doors closed, especially in rollover accidents. However, the lifesaving potential of a positive-acting door lock is still there. We have simply failed to exploit it. But the seven-step process is self-correcting—we may not hit our target on the first shot, but we learn from our mistakes. Next time our aim should be much better.

Lifesaving Potential of Door Locks

Q. You keep talking about the lifesaving potential of door locks, but can you really show that there is such a potential?

A. To make a careful estimate of the potential savings in lives from prevention of ejection requires a fairly extensive statistical analysis such as the one given by Boris Tourin (1).

Q. Can you show me how lives could be saved—without going into a lot of confusing statistical technicalities?

A. Well, I can show you—roughly, at least—how a good proportion of the deaths in the ACIR sample of rural injury-producing accidents might have been prevented by a positive door lock. I can do this directly from the raw data given in table 3. To avoid too many numbers, I have consolidated the data into 12 accident circumstances, and table 3 shows the number of fatalities and the number of occupants in each of the circumstances.

Q. What are the circumstances?

A. I have combined the accident configurations into three categories (good, fair, poor) for reasons which will become clear in the course of the discussion. I have considered just two applicable impact speeds (under 60 miles per hour, 60 miles per hour and over). For simplicity, I have given only two ejection categories—not ejected and completely ejected through doors. I have omitted complicated

kinds of ejection (partial ejection, ejection not through doors). Hence there are $3 \times 2 \times 2 = 12$ circumstances shown in table 3.

Q. What am I supposed to look for in table 3.

A. Let's start with the cell in the upper left-hand corner, the nonejectees in low-speed accidents in the "good" accident configurations. What do you notice about the risk of death for these occupants?

Q. It's pretty small—less than 1 in 100. What does this mean?

A. To see what this means, take a look at the next cell in the row—the person in low-speed accidents in "good" configurations who were ejected. There are 521 of the ejectees and 42 of them were killed. Now let us suppose that all cars had positive door locks and that these 521 persons would have stayed inside of the car. Under this assumption, these 521 persons would have had the event-chains characteristic of nonejectees instead of the event-chains characteristic of ejected occupants. Now if these people had stayed inside the car, how many of them would have been killed?

Q. When a person is actually thrown out of the car, how can you possibly know what would have happened to him if he had stayed inside?

A. We can't know what would have happened to a particular individual. However, we can make some estimate of what would have happened in the series of 521 occupants. From the upper left-hand cell we can directly estimate the risk of death for occupants who stay inside of the car (0.006). If we suppose this same risk applies to the 521 persons who were hypothetically held inside by a positive door lock, then we can find the "expected" number of deaths in the series by simple multiplication— $521 \times 0.006 = 3.2$. In other words, under the above assumptions we would have expected only about 3 deaths in this series of 521 occupants.

Q. But there were really 42 people killed. What does the three "expected" deaths mean?

A. Well, by this line of reasoning, 39 of the 42 deaths could have been prevented by positive door locks. In other words, the great majority of these deaths were unnecessary. Now let's apply the same reasoning to the high-speed accidents in the "good" category. What do you notice in table 3?

Q. The risk of death goes up a bit for non-ejectees, but it is still only a little more than 1 in 100. So by your argument most of the 73 deaths in the upper right-hand cell could also have been avoided. That's your point, isn't it?

A. Yes. We would expect only about 5 deaths in the 361 ejectees, and so positive door locks might have saved about 68 lives. Hence in the "good" accident configurations we might have avoided $39 + 68 = 107$ of the 137 deaths. Of course, the situation is much less favorable in other accident configurations.

Q. What happens in the "fair" configurations?

A. A positive door lock might have saved about 31 of the 137 deaths—roughly one-fifth of the toll, with most of the savings coming from the lower speed ejectees. Hence the positive door lock is just a start—though a good start—toward cutting the death toll in "fair" configurations.

Q. What about the "poor" configurations?

A. You'll notice that ejectees account for only 32 of the 177 fatalities. Moreover, the differential in the risks between ejectee and nonejectee has become smaller, though ejectees still have the higher risks. Thus door locks could be expected to save only about 11 lives in the "poor" configurations. When we total up the savings in lives over all the configurations, it turns out to be about 150, or one-third of the 451 deaths in table 3. However, we couldn't hope to cut the national death rates

by this much because no door lock could hold 100 percent of the time, because the door lock would probably be less effective in urban accidents, and for some other reasons. Nevertheless, we would be getting a big saving in lives for a rather small price—an extra quarter of an inch of steel in the door lock. I might note here that a majority of the occupants in table 3 were in cars equipped with the modified door locks.

Other Strings in the Bow

Q. Positive door locks alone couldn't cut the highway toll in half, could they?

A. No, door locks are no panacea. They are just one of a series of design changes that would be needed to do the job. I have emphasized door locks because they provide a clear-cut example of the scientific process.

Q. What other design changes are needed?

A. Quite a list of preventive measures has come out of the ACIR studies and other investigations. I won't have time to go into this list. There are a number of design changes that are effective only in certain specific accident circumstances. There are other design changes that would be important in a wide range of accident situations. The seven-step process would apply to any of these safety features.

Q. What about seat belts?

A. I won't say much about seat belts here because they will be the subject of another ACIR paper. In brief, it is found from Cali-

Table 3. Number of occupants and fatalities in 12 accident circumstances

Accident configuration	Class of occupants	Applicable impact speed				Total
		Under 60 m.p.h.		60 m.p.h. and over		
		Not ejected	Ejected	Not ejected	Ejected	
Good (IV, VII, VIII)-----	{Fatalities-----	15	42	7	73	137
	{All occupants-----	2, 478	521	497	361	3, 857
Fair (III, V, IX)-----	{Fatalities-----	52	31	42	12	137
	{All occupants-----	4, 294	319	319	59	4, 991
Poor (I, II, VI)-----	{Fatalities-----	88	15	57	17	177
	{All occupants-----	2, 975	294	305	63	3, 637
	Total fatalities-----	155	88	106	102	451
	Total occupants-----	9, 747	1, 134	1, 121	483	12, 485

fornia data that a seat belt is of value in keeping the occupants inside the car. However, the study failed to demonstrate that the seat belts were of value in preventing contact with an interior structure. Hence the seat belt seems to be a useful interim measure to control ejection, but it has the drawback that its effectiveness depends upon the willingness of the occupants to use the belts. In the California study about two-thirds of the occupants in cars equipped with seat belts were not wearing them at the time of the accidents.

Q. Can you give some examples of the design modifications that apply to specific accident circumstances?

A. Each accident circumstance has its own particular problems and hence tends to highlight particular components of the car. For instance, in a rollover, it is important to prevent the top structure from caving in during the roll. During the past few years the top supports appear to have been dangerously weakened by the trend to "hardtop" styling. To reverse this trend, safety has to be given priority over style. Another good example of the special problems of an accident configuration occurs when one vehicle rams into the rear of another one—the overtake accident. By Newton's third law, the forces on the two vehicles are equal and opposite. However, it turns out that the risks in the trailing car are considerably higher than those in the leading car.

Q. Why is this?

A. One possible explanation is that the rear impact on the leading car throws the occupants back into their seats. In effect, then, the leading car has the "rearward facing seats" that have been often advocated as a protective measure. A second, and more important, factor emerges when "car-car" accidents are separated from "car-other vehicle" accidents ("other vehicles" are mostly trucks). It would appear that much of the trauma in the trailing cars occurs when they run into heavy, high-bed trucks. This in turn suggests that the rear structure of trucks be redesigned—particularly to prevent a low-hooded car from running under the bed of the truck. Although the injury picture is favorable in the leading car, it could still be improved. Here the indicated de-

sign changes would focus on seat backs—particularly for the right front seat occupant. Perhaps these brief remarks will give some idea of how protective measures can be developed for specific accident situations.

Q. What are some of the design changes that are important over a wide range of accident circumstances?

A. One design change is suggested by table 3. You will notice that a substantial proportion of the deaths among nonejectees occur in accidents where the applicable impact speed is 60 m.p.h. or more. Because there is usually some braking action prior to impact, the impact speed tends to be somewhat more than 10 m.p.h. lower than the traveling speed. This means that one of the cars in the high-impact speed accidents was likely to have been traveling at more than 70 m.p.h. However, it is not a difficult technological problem to prevent cars from traveling more than 70 m.p.h.

Q. Hasn't speed restriction often been tried?

A. Past efforts at speed control have emphasized education or law enforcement, but the direct method of control by engineering has been shunned. I would suggest that it be mandatory for all new cars to be equipped with a sealed governor set at 70 m.p.h. To get such hardware on all U.S. cars would require close cooperation between manufacturers, legislators, and law enforcement agencies—and public support—but it isn't an impossible task. A 70 m.p.h. limit would not interfere with the efficiency of the automobile as a means of transportation—only a tiny minority of motorists actually do much sustained driving at speeds in excess of 70 m.p.h. Nor is this any more of an infringement on personal liberty than our present laws against suicide. You can see from table 3 that the lifesaving potential is considerable—especially in the "fair" configurations.

Q. Are there other examples of design changes with a broad scope?

A. Delethalization is another major line of development.

Q. What is delethalization?

A. Broadly speaking, it means getting rid of pointed objects, projections, sharp bends in instrument panels, and other hazards in the car

interior. An effective delethalization program requires a careful study of the relationship between specific components—steering wheels, for instance—and specific kinds of injuries—such as chest injuries. Apparently minor matters—such as the number of spokes in the wheel—are likely to be the key to effective delethalization. Each individual modification may seem unimportant, but collectively they can produce a worthwhile reduction in the highway toll.

Q. In all of the examples that you've mentioned, the design changes have been made in the vehicles. Are there other kinds of design changes that are promising?

A. Yes, highway design and traffic control devices also provide promising preventive measures. For example, the "poor" configurations are head-on collisions, broadside accidents (impact on the passenger compartment), and one-car collisions with immovable objects. These configurations are fairly rare on limited-access divided highways of modern design. On the older highways, improved traffic control devices could reduce the frequency of these "poor" configurations. Future research will probably reveal still other ways to influence the event-chains in automobile accidents—but even if we merely exploited our present leads, we could cut the highway toll in half.

Summing Up

Q. What, then, are your overall conclusions about the auto accident problem?

A. To sum up:

There is a practical, scientific approach to the highway accident problem. The strategy, tactics, and basic data for this approach have already been developed and tested.

Scientific investigation of the accident event-chains has suggested a series of preventive measures which have a high potential for the reduction of deaths and serious injuries.

These preventive measures need to be translated into design changes, or "hardware"; the hardware has to be installed on American cars and tested on the road. This is the present bottleneck.

The wholehearted cooperation of groups with a stake in the auto accident problem is needed to break the bottleneck. Vigorous public support of this scientific program could insure the necessary cooperation.

Assuming reasonable cooperation, it would be realistic to set the following target for 1970: A 50 percent reduction in the deaths and serious injuries sustained by occupants of cars in highway accidents.

REFERENCE

- (1) Tourin, B.: Ejection and automobile fatalities. Pub. Health Rep. 73: 381-391, May 1958.

NOTE: This paper was prepared with the help of Mrs. Barbara McNulty and Mrs. Charlotte Zweifach, who carried out the numerical analyses for this paper, and of the Automotive Crash Injury Research staff, who provided the information in machine runs for this material.

Occupational Health Course for Local Officers

A training course in occupational health for local health officers was held in Jacksonville, Fla., May 5 and 6, 1960. Co-sponsored by the Occupational Health Branch, Public Health Service, and the division of radiological and occupational health, Florida State Board of Health, the course was designed to intensify the awareness, on the part of local health officers, of the significance of occupational health questions and of the ways in which basic health department staffs can contribute to this field of health.

In addition to local health officers, public health nurses and sanitarians were attracted to the course, bringing the total number of participants to 94.

Note on Cigarette Smoking and Lung Cancer

Since the publication of my article, "Tobacco Consumption and Mortality from Cancer and Other Diseases" (*Public Health Reports* 74: 581-593, July 1959), I have received several requests for age-specific mortality rates for lung cancer, particularly among cigarette smokers.

The following table presents age-specific mortality rates computed from the same data as the mortality ratios given in the previous publication. The rates are shown only for ages 55 years and over since the number of deaths for the younger age groups during the period included was not large enough to warrant the computation of age-specific rates.

Among men who were currently smoking cigarettes and who had never used tobacco in any other form, the death rate from lung cancer for each age group consistently increased with an increase in the average daily consumption of cigarettes. The increase in the death

rate for heavy smokers—more than a pack a day—relative to that of light smokers—less than one-half pack per day—was highest for the youngest age group, 55-59 years, and decreased with advancing age. The death rate for heavy smokers was 3.9 times that for light smokers at ages 55-59 years; for the age groups 60-64 years and 65 years and over the corresponding ratios were 2.9 and 1.5.

All groups of men currently smoking only cigarettes experienced a definitely greater risk of dying from cancer of the lung than did nonsmokers. The death rate from lung cancer for men who were smoking more than a pack of cigarettes per day was 14 times greater than the rate for nonsmokers at ages 55-59 years, 19 times greater at ages 60-64 years, and 11 times greater at ages 65 years or more.—HAROLD F. DORN, chief, Biometrics Research Branch, National Heart Institute, National Institutes of Health, Public Health Service.

Number of deaths and death rate per 100,000 per year from lung cancer by age, smoking history, and current amount smoked, U.S. Government life insurance policy holders, July 1954-December 1956¹

Smoking history and current amount smoked	Rate per 100,000				Number of deaths		
	55 and over	55-59	60-64	65 and over	55-59	60-64	65 and over
Never smoked ²	16.6	12.2	14.1	31.6	5	6	6
Cigarettes—total: ³							
All amounts	158.8	112.9	175.3	261.7	72	94	52
— 10 per day	110.9	47.3	100.2	261.1	4	9	11
10-20 per day	137.1	91.2	151.9	230.1	27	41	24
21 or more per day	210.0	159.6	249.2	325.4	41	44	17
Cigarette only: ³							
All amounts	179.2	134.1	201.1	275.7	55	67	32
— 10 per day	104.5	48.2	92.5	242.8	2	4	5
10-20 per day	162.4	115.3	181.2	254.2	22	31	16
21 or more per day	224.9	174.5	269.4	338.0	31	32	11
Cigarette and other: ³							
All amounts	124.7	74.7	132.9	242.1	17	27	20
— 10 per day	116.9	46.4	107.4	278.6	2	5	6
10-20 per day	93.8	47.6	101.2	193.4	5	10	8
21 or more per day	178.6	126.1	207.7	304.6	10	12	6

¹ The number of deaths includes all deaths with a diagnosis of lung cancer, whether considered as a primary, contributory, or non-contributory cause of death. ² Includes occasional smokers of any form of tobacco, past or present. ³ Includes only persons currently smoking cigarettes.

Controlled Trial of BCG Vaccination in a School Population

GEORGE W. COMSTOCK, M.D., Dr.P.H., and LAWRENCE W. SHAW, M.A.

THE ROLE of BCG vaccination in tuberculosis control programs has been cloaked with controversy almost since the day in 1921 when BCG was first administered to a human subject (1). Although some aspects of the problem have been clarified by controlled field trials of vaccination, divergent conclusions have been reached regarding its usefulness. This is well illustrated by two of the most recently reported trials, one involving a quarter of a million participants in Puerto Rico and the southeastern United States, and the other, 56,700 subjects in Great Britain (2,3). Both reports agreed that the risk of developing tuberculosis was considerable among reactors to a low dose of tuberculin. But for nonreactors, the British found a high risk of developing disease and substantial protection from vaccination, while the American trials led to the opposite conclusions, namely, that the risk for nonreactors was low and that the benefits conferred by vaccination were too slight to counterbalance its disadvantages. Nevertheless, midst the welter of conflicting findings and opinions, there appears to be growing acceptance of the view that BCG vaccination should not be used in populations whose risk of becoming infected with *Mycobacterium tuberculosis* is slight (4-7).

The validity of this view is illustrated by the results of a controlled trial of BCG vaccination among the school population of Mus-

cogee County, Ga., begun in April 1947. Observations during the ensuing 12 years show that the infection rate in the community has been low and diminishing, that reactors to a low dose of tuberculin ran the greatest risk of developing tuberculous disease, and that BCG vaccination had no demonstrable effect on the tuberculosis problem.

Procedures

The tuberculin testing and BCG vaccination procedures have been described (8). Briefly, all participants were tested with 5 T.U. of PPD, and the nonreactors to this dose were tested with 100 T.U. of PPD. The PPD was supplied by the State Serum Institute of Copenhagen, Denmark, and was designated as lot RT 18. Throughout this report, reactors are defined as persons with 5 millimeters or more of induration to the specified dose of PPD. To allay concern on the part of parents and teachers, reactors to the 5-T.U. dose were advised to have a chest X-ray. No further followup examinations were advised for reactors with negative chest X-rays because it was then generally believed that their risk of developing tuberculosis was slight.

Because a negative reaction to the 100-T.U. dose was considered to be a necessary prerequisite for vaccination in 1947, all nonreactors to the 5-T.U. test were given the larger dose. For those who reacted to the 100-T.U. test, nothing more was advised. Nonreactors were divided into two groups on the basis of their birth year. One group was vaccinated and the other was left unvaccinated as a con-

Dr. Comstock is chief, Epidemiological Studies, and Mr. Shaw is chief, Records and Statistical Services, Tuberculosis Branch, Public Health Service. This paper is sixth in a series.

trol. The vaccine, supplied by Dr. S. R. Rosenthal of the Research Foundation, Chicago, Ill., was administered by multiple tangential acupuncture on the third or fourth day after preparation.

Six months later, 70 percent of the vaccinated students were retested with 5 T.U. and 100 T.U. of PPD. At that time 45 percent were reactors to the 5-T.U. dose, and 93 percent reacted to the 5- or 100-T.U. doses. The nonreactors to the 100-T.U. dose were revaccinated.

Cases among the study population were identified through the normal casefinding and reporting facilities in the county. The mechanics of case identification were simplified by combining tuberculosis control and research activities in the metropolitan area into a single facility, the Muscogee County Tuberculosis Study (9). Because of the extensive casefinding conducted in this area and the highly cooperative attitude of the local physicians, it is very unlikely that important cases of tuberculosis have been missed among the resident population even though no effort was made to examine each participant periodically. The records of persons classified as tuberculosis cases or suspects were matched with a master index file which contained the tuberculin and vaccination status of participants in the 1947 trial. The 1947 tuberculin and vaccination status was not recorded on the clinic case records.

The Study Population

Approximately 16,000 children were enrolled in the schools of Muscogee County in 1947. The study population is restricted to 11,262 children whose 5-T.U. tests were read at 48 hours. These children came from all grades of the city, county, and parochial school systems. All but 1.5 percent were between the ages of 5 and 19 years, the average age being 11.4 years. The subdivision of this population into study categories is shown in table 1. Of the total, 1,492, or 13 percent, had positive reactions to 5 T.U. of PPD. Another 3,768, one-third of the study population, were classified as reactors to the 100-T.U. dose. The 5,261 nonreactors to both doses were to be divided into two roughly equal groups, one to be vaccinated and the other to be left unvaccinated as controls. However, 422 were classified as "irregulars" since they did not qualify for the vaccinated or control groups for such reasons as refusal to accept vaccination if offered or medical contraindications to vaccination.

There was a marked difference between the two races with respect to tuberculin sensitivity to the 5-T.U. test. Only 8 percent of the white children were classified as reactors to 5 T.U. compared with 26 percent of the Negro children. The distribution of the 5-T.U. reaction sizes is shown for each race in the chart. Three-fifths of the Negro reactors but only two-fifths of the white reactors had 10 mm. or more of indura-

Table 1. Composition of study population, by tuberculin and vaccination status and race, Muscogee County, Ga.

Tuberculin and vaccination status	Both races		White		Negro	
	Number	Percent	Number	Percent	Number	Percent
<i>5-T.U. tests</i>						
Completed tests	11,262	100.0	7,767	100.0	3,495	100.0
Reactors	1,492	13.2	590	7.6	902	25.8
Nonreactors	9,770	86.8	7,177	92.4	2,593	74.2
<i>100-T.U. tests</i>						
Completed tests	9,029	80.2	6,675	85.9	2,354	67.4
Reactors	3,768	33.5	2,606	33.6	1,162	33.2
Nonreactors	5,261	46.7	4,069	52.4	1,192	34.1
Controls	2,341	20.8	1,818	23.4	523	15.0
Vaccinees	2,498	22.2	1,948	25.1	550	15.7
Irregulars	422	3.7	303	3.9	119	3.4

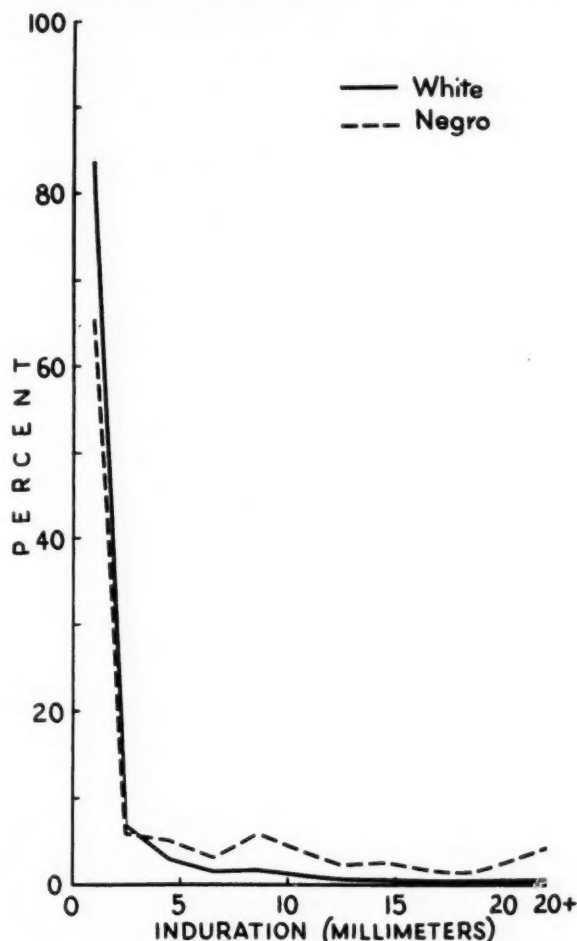
tion. A surprising finding at the time was that the proportion of the study population reacting only to the 100-T.U. dose was similar for whites and Negroes. In addition, while the frequency of reactions to the 5-T.U. test, particularly those of 10 mm. or more, were in line with other indices of the tuberculosis problem in the two races, those to 100 T.U. were not. The failure of the 100-T.U. reactions to reflect the extent of the tuberculosis problem in the various subgroups of the community was one of the early clues to the existence and high prevalence of nonspecific tuberculin sensitivity in the southeastern United States (10). Because of the use of the 100-T.U. dose, only one-half of the white children and one-third of the Negro children were eligible for vaccination.

Estimating the Infection Rate

One reason for selecting Muscogee County, Ga., as the site for a field study of tuberculosis and BCG vaccination was the belief that the tuberculosis problem in this area is not too different from that of the United States as a whole. However, weak sensitivity to tuberculin, especially that elicited only by the 100-T.U. dose, was prevalent to an unusual degree. Subsequent studies have shown that most of this weak sensitivity can be attributed to sources other than *M. tuberculosis* (11-13). This has an important bearing on the use of conversion rates as an index of the risk of acquiring specific tuberculous infection. In this area, it now appears that most of the reactions to 5 T.U. of PPD with induration less than 10 mm., and some of the larger reactions as well, are caused by an agent other than *M. tuberculosis* (14). Consequently, in this paper, a conversion will be defined as a reaction to the 5-T.U. dose which changes from less than 5 mm. to more than 10 mm. of induration. It is believed that the conversion rate, so defined, will approximate the tuberculosis infection rate reasonably well.

The infection rate in the school population in this area can be estimated from the results of two tuberculin surveys in the school system subsequent to the 1947 BCG trial. The first was the 1950 BCG trial, in which 5 T.U. of PPD (RT 19-20-21) was used (2). The second survey in 1957 covered all junior and

Percentage distribution of the study population by initial reaction to 5 T.U. of PPD, by race, Muscogee County, Ga.



senior high schools in Muscogee County and in Russell County, Ala. (the county adjoining Muscogee County to the west and part of the same metropolitan area). The tuberculin used in the second survey was also 5 T.U. of PPD (RT 19-20-21). At the time of testing and reading, the observers did not know the tuberculin and vaccination status of the children in the 1947 or 1950 trials.

In the spring of 1950, 1,379 controls from the 1947 trial were tested. All of these 1,379 subjects had less than 5 mm. of induration to both 5- and 100-T.U. tests in 1947. Three years later, 0.9 percent of the whites and 4.9 percent of the Negroes had reactions larger than 10 mm. to the 5-T.U. dose (8). This is equivalent to an average annual infection rate of about 0.3 percent for whites and 1.7 percent for Negroes.

Too few controls from the 1947 program were tested in 1957 to yield reliable results. However, 611 students who were controls in the 1950 trial were retested in April 1957. At that time, 1.3 percent of the white controls and 4.7 percent of the Negro controls had converted from less than 5 to more than 10 mm. of induration to 5 T.U. of PPD. This is equivalent to an average annual infection rate of 0.2 percent for whites and 0.7 percent for Negroes.

These infection rates have been calculated as an average over a period of years. They were lower in the second period than in the first. Therefore, it is not unreasonable to assume that they have been decreasing over the entire 10-year period, and that the rate for 1957 was about 0.1 percent per year for whites and 0.3 percent for Negroes. The rate for whites is essentially the same as that estimated for white naval recruits from all sections of the United States (15). It appears likely that the risk of becoming infected with *M. tuberculosis* in

Muscogee County is not too different from the average risk in the country as a whole, and that the risk in Muscogee County, again like most other parts of the Nation, is not only low but has been diminishing.

Comparison of Controls and Vaccinees

The similarity of the vaccinated and control groups with respect to certain characteristics is shown in table 2. Controls and vaccinees were almost identical in their race, sex, and age composition. Their initial sensitivity to both doses of tuberculin was likewise almost the same. The similarity of their participation in the 1950 trial suggests that both groups remained in the community and participated in subsequent community programs to almost the same extent. Consequently, there is no reason to believe that the procedure for allocating some persons eligible for vaccination to the control group and others to the vaccinated group was not successful in producing two essentially similar subgroups of the study population.

Table 2. Comparison of controls and vaccinees, Muscogee County, Ga.

Characteristic	Controls	Vaccinees
Number	2,341	2,498
Race (percent):		
White	77.7	78.0
Negro	22.3	22.0
Sex (percent):		
Male	48.1	45.6
Female	51.9	54.4
Mean age (years)	9.7	9.6
Initial reaction to 5 T.U. of PPD (percent):		
No reaction	83.3	84.1
Erythema only	12.0	11.7
1-4 mm. induration	4.7	4.1
Initial reaction to 100 T.U. of PPD (percent):		
No reaction	49.0	48.2
Erythema only	34.7	36.9
1-4 mm. induration	16.3	14.8
Participation in 1950 BCG program (percent)	58.9	57.9

Cases of Tuberculosis

In the 12-year period, April 1, 1947, through March 31, 1959, 44 members of the study population were classified as tuberculosis cases or suspects. As can be seen in table 3, most of them were among the reactors to 5 T.U. of PPD. Of the total group of 44 cases, one was known to the Muscogee County tuberculosis study prior to the 1947 trial; 4 others were later classified as nontuberculous. These five persons have been excluded from the study group of cases. Also excluded are four persons classified as suspected cases of tuberculosis. The only evidence shown by three of them was an indeterminate shadow on the chest X-ray which was not characteristic of tuberculosis. The fourth suspect, who was a reactor to the 5-T.U. dose in 1947, had disease of a submental lymph node, from which acidfast bacilli were demonstrated by smear on one occasion. Cultures were negative, and the clinical course was not characteristic of tuberculosis.

Restricting the cases to the 35 persons whose tuberculosis was classified as definite and who

Table 3. Final classification of participants classified at some time during the study as tuberculosis cases or suspects, by 1947 tuberculin and vaccination status, Muscogee County, Ga.

Classification	Total	Reactors, 5 T.U.	Nonreactors, 5 T.U.			
			Not tested, 100 T.U.	Reactors, 100 T.U.	Nonreactors, 100 T.U.	
					Controls	Vaccinees
Participants ever classified as tuberculosis cases or suspects	44	28	3	7	2	4
Cases known prior to 1947 program	1	1	0	0	0	0
Later discharged as nontuberculous	4	2	¹ 1	1	0	0
Suspected cases	4	1	0	1	0	2
Definite cases	35	24	2	5	2	2

¹ Also diagnosed prior to 1947 program.

were first diagnosed after the program started removes four cases from the 5-T.U. reactors, two from the 100-T.U. reactors, none from the controls, and two from the vaccinees. The net effect of these exclusions is to decrease the relative magnitude of the tuberculosis problem among reactors as compared with nonreactors, and also among vaccinees as compared with controls.

The type and stage of disease of the study group of cases is shown in table 4, according to the organ and degree of most serious involvement. Of the 35 definite cases, 28 were solely or predominantly pulmonary tubercu-

losis, and 7 nonpulmonary; 20 of these definite cases had one or more bacteriological examinations reported as positive for acidfast bacilli. There were no significant differences between the subgroups of the study population with respect to the proportion of cases bacteriologically confirmed.

Most of the definite cases had serious disease. Twenty of them had had either advanced pulmonary disease or serious forms of nonpulmonary tuberculosis. In addition, 20 of the 35 had positive bacteriological examinations, 15 by smear and culture of sputum specimens, 4 only by culture of sputum, and 1 only by cul-

Table 4. Classification of cases, by tuberculin and vaccination status, Muscogee County, Ga.

Tuberculosis classification	Total	Reactors, 5 T.U.	Nonreactors, 5 T.U.			
			Not tested, 100 T.U.	Reactors, 100 T.U.	Nonreactors, 100 T.U.	
					Controls	Vaccinees
Total	35 (20)	24 (13)	2 (1)	5 (3)	2 (2)	2 (1)
Pulmonary	28 (20)	20 (13)	1 (1)	4 (3)	2 (2)	1 (1)
Far advanced	9 (9)	¹ 5 (5)	1 (1)	2 (2)	1 (1)	
Moderately advanced	9 (8)	6 (5)		1 (1)	1 (1)	1 (1)
Minimal	6 (3)	5 (3)		1		
Primary	4	4				
Nonpulmonary	7	4	1	1	0	1
Meningeal	1	¹ 1				
Bone and joint	1	1				
Lymph node	1	1				
Pleurisy with effusion	4	1	1	1		1

¹ 1 death from tuberculosis in each of these two groups.

NOTE: Numbers in parentheses indicate those with bacteriological examinations positive for acidfast bacilli.

Table 5. Treatment advised for definite cases, by tuberculin and vaccination status, Muscogee County, Ga.

Treatment advised	Total	Reactors, 5 T.U.	Nonreactors, 5 T.U.			
			Not tested, 100 T.U.	Reactors, 100 T.U.	Nonreactors, 100 T.U.	
					Controls	Vaccinees
Total.....	35	24	2	5	2	2
Hospitalization.....	21	14	1	3	2	1
Home treatment.....	2	1	0	0	0	1
None.....	12	9	1	2	0	0

ture of gastric washings. The severity of disease is also reflected in table 5, which shows that 21 cases were advised to be treated in a tuberculosis hospital. All but one (a control) accepted this advice. Most cases occurred at a time when there were enough hospital beds for sick and infectious patients, but not enough to hospitalize cases of doubtful clinical significance.

On the whole, the outcome for these cases was quite favorable, as shown in table 6. Almost all were entirely well and leading normal lives on October 1, 1959. Two were still under treatment and 2 had died, both prior to the availability of isoniazid. One fatal case occurred in a Negro girl with far advanced pulmonary tuberculosis diagnosed in January 1951, who died in December 1951. The other was in a white girl whose primary lesion was detected a few weeks after the program started. She developed tuberculous meningitis and died in March 1948. There were no significant differences between reactors and nonreactors with

respect to the treatment advised or the outcome of disease.

The year in which the definite cases were first recognized is shown in table 7. Among 5-T.U. reactors, 80 percent were diagnosed in the first 5 years following the initiation of the trial, compared with only 1 of 11 cases occurring among nonreactors to the 5-T.U. dose. Among nonreactors to the 100-T.U. dose, all four cases came to recognition in the last 6 years of the observation period.

Among the 5-T.U. reactors, five cases were diagnosed in the first month after the trial started, all as a result of chest X-rays advised for reactors to the first tuberculin test. All but one of the remaining cases among 5-T.U. reactors and all but one of the nonreactors to 5 T.U. had one or more negative chest X-ray examinations prior to the date of diagnosis. Consequently, 28 of the 35 cases represent recognizable disease known to have developed after the initiation of the trial. Rates based on these 28 cases give a minimum measure of incidence,

Table 6. Health and treatment status on October 1, 1959, of definite cases, by tuberculin and vaccination status, Muscogee County, Ga.

Health and treatment status	Total	Reactors, 5 T.U.	Nonreactors, 5 T.U.			
			Not tested, 100 T.U.	Reactors, 100 T.U.	Nonreactors, 100 T.U.	
					Controls	Vaccinees
Total.....	35	24	2	5	2	2
Dead from tuberculosis.....	2	2	0	0	0	0
Disabled, under treatment.....	1	0	0	1	0	0
Well, under treatment.....	1	1	0	0	0	0
Well, no treatment.....	31	21	2	4	2	2

Table 7. Year in which definite cases of tuberculosis were first recognized by tuberculin and vaccination status, Muscogee County, Ga.

Year of recognition	Total	Reactors, 5 T.U.	Nonreactors, 5 T.U.			
			Not tested, 100 T.U.	Reactors, 100 T.U.	Nonreactors, 100 T.U.	
					Controls	Vaccinees
Total	35	24	2	5	2	2
1st	5	¹ 5				
2d	2	2				
3d	4	4				
4th	4	² 4				
5th	5	4		² 1		
6th	1		1			
7th	3	1			2	
8th	5	2	1	2		1
9th	2			1		
10th	2	1				1
11th	2	1		1		
12th	0					

¹ All diagnosed in April 1947.

² One case who did not have a negative chest X-ray at least once prior to diagnosis.

or the "development" of new cases of disease. Rates based on the total group of 35 cases reflect newly "reported" tuberculosis.

Newly Reported Cases of Tuberculosis

The average annual rate of newly reported cases among the total study population was 26 per 100,000, as shown in table 8. The rate for 5-T.U. reactors was tremendously higher than for nonreactors, 134 for reactors and only 9 for nonreactors. No significant differences were noted among nonreactors to 5 T.U. according to

their sensitivity to the 100-T.U. dose. The rates among controls and vaccinees were the lowest observed and were essentially the same.

The degree of sensitivity in 1947 to 5 T.U. of PPD appeared to be closely related to the tuberculosis case rate. This is shown in table 9. Persons with no induration to the 5-T.U. test had the lowest rates, whereas persons with 10 mm. or more of induration had extremely high rates. The case rate among Negroes was appreciably higher than among whites at all levels of initial sensitivity to tuberculin, the difference being most marked among students

Table 8. Cases of definite tuberculosis among participants and average annual rates per 100,000 population, by tuberculin and vaccination status, Muscogee County, Ga.

Item	Total	Reactors, 5 T.U.	Nonreactors, 5 T.U.			
			Not tested, 100 T.U.	Reactors, 100 T.U.	Nonreactors, 100 T.U.	
					Controls	Vaccinees
Participants	11, 262	1, 492	741	3, 768	2, 341	2, 498
Definite cases	35	24	2	5	2	2
Average annual rates per 100,000.	25. 9	134. 0	22. 5	11. 1	7. 1	6. 7

NOTE: 422 nonreactors to 100 T.U. classified as "irregulars" had no cases of tuberculosis and, although included in the total, are not shown separately in the table.

Table 9. Tuberculosis case rates among participants, by race and size of reaction to 5 T.U. of PPD, Muscogee County, Ga.

Induration to 5 T.U. (mm.)	Both races			White			Negro		
	Popula- tion	Cases		Popula- tion	Cases		Popula- tion	Cases	
		Number	Rate ¹		Number	Rate ¹		Number	Rate ¹
Total-----	11, 262	35 (7)	25. 9	7, 767	5 (2)	5. 4	3, 495	30 (5)	71. 5
0-----	7, 090	7 (1)	8. 2	5, 265	1	1. 6	1, 825	6 (1)	27. 4
1-4-----	2, 680	4	12. 4	1, 912	0	-----	768	4	43. 4
5-9-----	698	5	59. 7	337	1	24. 7	361	4	92. 2
10 and greater-----	794	19 (6)	199. 0	253	3 (2)	98. 8	541	16 (4)	246. 4

¹ Average annual rate per 100,000.

NOTE: Numbers in parentheses are persons without negative X-rays prior to diagnosis.

with little or no induration to the initial test. For possible application to tuberculosis control programs, it is worth noting that children with 5-T.U. reactions of 10 mm. or more comprised only 7 percent of the total study population, but yielded 54 percent of the total cases over the 12-year period. During the first 5 years of observation, the same 7 percent yielded 80 percent of the cases.

Even though there were very few cases among nonreactors to the 5-T.U. dose, their known characteristics were examined to see if any hint of a high-risk subgroup could be detected. Aside from the fact that 10 of the 11 cases were in Negroes, this effort was not successful. There was no suggestion that the tuberculosis case rate was related to initial age,

sex, place of residence, or socioeconomic status as judged by housing characteristics in 1946.

Known Incidence of Tuberculosis

As noted previously, 28 of the cases among the study population had had at least one negative chest X-ray examination prior to the date of diagnosis of tuberculosis. These cases, whose disease is known to have developed after the start of the trial, may be used to measure the incidence of tuberculosis among the study population.

It is also possible to estimate the proportion of the study population remaining in the community during the 12-year observation period. In 1954, a 2 percent sample of the 1946 census

Table 10. Incidence of new cases of definite tuberculosis per 100,000 person-years experience at stated ages, by reaction to 5 T.U. of PPD, Muscogee County, Ga.

Age group (in years)	Reactors			Nonreactors		
	Person-years experience	New cases		Person-years experience	New cases	
		Number	Rate ¹		Number	Rate ¹
Total-----	13, 400	18	134	89, 000	10	11
5-8-----	400	0	-----	7, 500	0	-----
9-12-----	2, 000	2	100	20, 700	0	-----
13-16-----	4, 200	5	120	28, 400	2	7
17-20-----	4, 100	8	197	21, 600	4	19
21-24-----	2, 300	3	130	9, 200	4	44
25-28-----	500	0	-----	1, 800	0	-----

¹ Cases per 100,000 person-years.

population was drawn for a survey of blood pressure levels in Muscogee County (16). From that sample, the proportion of the population remaining in the metropolitan area 8 years later was calculated. Over the initial age span of 5 to 18 years, which includes almost all of the present population, it was found that older children had left the community to a somewhat greater extent than younger children, and whites somewhat more than Negroes.

Applying the race-age specific rates of emigration to the study population allows an estimate of the number of children remaining in the community at the end of each year of the observation period. From such a tabulation, it is then possible to estimate the number of person-years of experience contributed by members of the study population for each year of age.

If the newly developed cases are allocated to the year of age at which they were first diagnosed, an estimate of the incidence rate for successive age groups can be developed. This is shown in table 10 for reactors and non-reactors to 5 T.U. of PPD during the age span 5 to 28 years of age.

The incidence rate for reactors to the 5-T.U. dose is 134 per 100,000 person-years of observation, slightly more than 12 times that for nonreactors. For both reactors and nonreactors, higher rates are observed in the older age groups. This finding is consistent with observations of other workers that the years of late adolescence and early adult life comprise one of the periods of greatest risk from tuberculous disease (17-19).

Discussion

The findings of this study support the conclusions of subsequent controlled trials of BCG vaccination in Puerto Rico, Georgia, and Alabama (2). The most striking finding of those trials, and of the present trial as well, was that persons who were reactors to 5 T.U. of PPD had the greatest risk of developing tuberculosis. A corollary to this finding is that nonreactors to the 5-T.U. dose had such a low risk of developing tuberculosis that there is serious question about the need for vaccination of nonreactors in this country. So low is this risk in the present study that after observing

nearly 10,000 children for a period of 12 years, only 10 cases of tuberculosis are known to have developed.

Although too few cases were observed among controls and vaccinees to attempt any assessment of the efficacy of vaccination among non-reactors, it is obvious that vaccination was not completely effective. Nor could failure be attributed to lack of trying. The vaccinees were retested 6 months after vaccination. At that time, 45 percent reacted to the 5-T.U. dose and 93 percent to the 100-T.U. dose. Those who had less than 5 mm. of induration to 100 T.U. were revaccinated. In the 1950 BCG trial, 42 percent of the vaccinees were again vaccinated, partly because of loss of allergy and partly because only the results of the 5-T.U. test were used in 1950 to select persons for vaccination. Although postvaccinal allergy in this trial was not nearly as marked as has been reported by others (20), the tuberculin sensitivity of the vaccinated group was increased appreciably by vaccination. It should also be kept in mind that there is far from universal agreement that ability of a vaccine to confer protection is necessarily dependent on its ability to produce strong allergy.

It is of some interest to note the postvaccinal allergy of the two cases which occurred among the vaccinees. Initially, neither of them had any reaction (erythema or induration) to 100 T.U. of PPD. Six months after vaccination, one subject still had no reaction to the 100-T.U. test. He was revaccinated and following this showed 15 mm. of induration to 100 T.U.; in 1950, he had 4 mm. of induration to the 5-T.U. test. The other subject had 12 mm. of induration to the 5-T.U. test 6 months following vaccination but was not tested in 1950.

Unfortunately, there were also too few cases among nonreactors to the 5-T.U. dose to cast much light on the attractive hypothesis that the agent responsible for low-grade tuberculin sensitivity in the southeastern United States also confers some resistance to tuberculosis, possibly by acting as a sort of natural vaccination (21). This may be so, but a higher attack rate than that observed among nonreactors in Muscogee County or a much larger study population would be necessary to test this hypothesis.

The conditions of the present trial are closer to the BCG trial conducted by the British Medical Research Council (3) than any controlled trials previously reported. Both populations were of school age, and although the British participants were initially 4 years older on the average than the Muscogee County children, the latter have been followed 5 years longer. The British students have been followed to an average age of 22 years, the Muscogee children to an average age of 23 years. In addition, like the British procedure, reactors to the 100-T.U. dose of PPD were excluded from both the control and vaccinee groups. Although chest X-rays were not routinely used in screening the Muscogee County participants, it is possible to classify all but two cases according to their initial X-ray status. Exclusion of the five cases diagnosed within a month of the initial tests and of the two cases without negative X-rays prior to diagnosis yields a group of cases reasonably similar to those developing among participants in the British trial.

Thus it is reasonable to compare the number of new cases observed during the first 8 years of the Muscogee County trial with the number expected had the rates among British participants for the first 7½ years applied to the Muscogee population. Although one could hardly expect exact agreement, one might anticipate that observed and expected numbers would be of the same order of magnitude if environmental conditions were reasonably similar. Conversely, if observed and expected numbers differed grossly, one might suspect that the characteristics of the two trial populations were dissimilar in some important respect.

Among reactors to the 5-T.U. dose in Muscogee County, 16 new cases are known to have developed in the first 8 years, where 12 would have been expected at the British incidence rates (with allowance for differences in tuberculosis risks for subjects with differing degrees of sensitivity to the 5-T.U. dose). This is quite close agreement, and suggests that the risk for British and Muscogee low-dose reactors is generally similar.

On the other hand, where 2 cases had been observed in the first 8 years among unvaccinated controls, 34 would have been expected had the British rates applied. This is quite a striking

difference and not likely to be explained by differences in age or race composition, case-finding procedures, or population losses. In fact, it is difficult to explain this difference in observed and expected cases on any basis except that the risk of infection for British school leavers must be very much higher than the risk in Muscogee County and in most parts of the United States.

Among the nonreactors to 5 T.U. who reacted to the 100-T.U. dose, 2 cases were observed; application of British rates indicates that 23 would have been expected. Although some of the 100-T.U. reactors in Muscogee County were vaccinated in 1950, the reduction in tuberculosis attributable to vaccination is too low in this population to account for much of the difference in observed and expected numbers. The simplest explanation is again that the infection rate from *M. tuberculosis* in British cities must have been much higher than in Muscogee County.

Among vaccinees, no cases were observed in the first 8 years. British experience suggests that six cases should have been expected.

It is of course possible that some of the differences between observed and expected numbers might arise from the application of British rates during late adolescence to Muscogee County children in a period of life when they would not be expected to have reached their age of greatest risk. However, table 7 shows that observation of cases for 4 more years, to the point where the age difference between the two study populations is no longer marked, does not increase the number of cases appreciably. Even comparing cases observed during 12 years with those expected during 8 years, had the British rates applied to this population, leaves considerable similarity for low-dose reactors (18 observed, 12 expected), and marked disparity for low-dose nonreactors with completed 100-T.U. tests (8 observed, 63 expected).

Comparison of the results of these two trials suggests that the risk of infection must have been many times higher in Great Britain than in the United States. This has a direct bearing on the need for vaccination in the two areas, since it seems obvious that the need for vaccination varies directly with the likelihood of becoming infected. No matter how effective a

vaccine may be, vaccination can have little impact on the tuberculosis problem when the risk of infection is as low as it is in most of this country today. Whether or not BCG can be expected to reduce morbidity rates among non-reactors in this country in areas where infection rates may still be high is a moot question. Certainly the low protection observed in the southeastern United States and in Puerto Rico gives little hope that BCG vaccination could be a useful tool elsewhere in this country (2).

One finding of this study relates to casefinding activities among school populations. The incidence of tuberculosis among the total study population was clearly too low to warrant any consideration of periodic chest X-ray examinations, and the infection rate has become too low to warrant annual tuberculin testing. However, the initial testing with 5 T.U. of PPD did delineate a high-risk group, namely, students with 10 mm. or more of induration. These students comprised only 7 percent of the population examined in 1947. Initially and in the ensuing 5 years, 80 percent of the cases were found among this small segment of the initial population. This finding strongly suggests that the currently popular tuberculin testing programs among school populations must be carefully done in all respects in order to define as sharply as possible the small group at greatest risk. Further, it appears that this small group should be kept under surveillance with annual chest X-rays for at least 5 years after a strongly positive tuberculin reaction has been discovered. Studies done elsewhere indicate that examination of all household associates of very young, strongly positive tuberculin reactors is a productive method of detecting cases of active tuberculosis and an important facet of tuberculin testing programs (22).

In areas where the infection rate is low, it seems that repeated tuberculin testing of entire school populations on an annual basis may well be inefficient since so few newly infected students could be discovered each year. In such areas, it would appear more reasonable to test the school population on entrance to school, and again during adolescence.

These recommendations would have sounded completely unrealistic in 1947. At that time, it seemed most important to find some way of

protecting the currently uninfected population from the presumed high risk of developing disease soon after infection had occurred. The healthy reactor then was viewed as having passed safely through the period of appreciable risk. Today, as a consequence of a number of studies on tuberculosis infection and incidence rates, it is recognized that tuberculosis among the currently uninfected population in the United States is not of critical importance, but rather that the already infected population is the important seedbed of future disease. As a result of this knowledge, it is now clear that in addition to efforts designed to identify infectious cases and to prevent them from creating new reactors, it is essential to discover some effective means of preventing the development of disease among apparently healthy reactors, thereby sterilizing the present seedbed of disease before another crop of tuberculosis cases can be germinated.

Summary

In April 1947, a controlled trial of BCG vaccination was initiated in the school population of Muscogee County, Ga. A total of 11,262 children had completed tests with 5 T.U. of PPD, and the nonreactors were tested with 100 T.U. The nonreactors to both doses were divided into two similar groups; one group was vaccinated with BCG and the other left unvaccinated as controls.

In the ensuing 12 years, 35 definite cases of tuberculosis were diagnosed among the study population, 24 among 5-T.U. reactors, 2 among 5-T.U. nonreactors who were not tested with 100 T.U., 5 among 100-T.U. reactors, and 2 each among controls and vaccinees. Three-fifths of the cases had clinically serious disease; a similar proportion were bacteriologically confirmed. There was no significant variation in type or extent of disease among the various tuberculin-vaccination subgroups of the study population. Most of the cases among 5-T.U. reactors were diagnosed during the first 5 years of observation; the few cases among nonreactors to 5 T.U. of PPD were scattered through the last 8 years of observation.

The average annual case rate for 5-T.U. reactors was 134 per 100,000; for nonreactors to 5 T.U. it was only 9 per 100,000. For both

controls and vaccinees, the rate was 7 per 100,000. There was a marked direct correlation of the tuberculosis case rate with size of reaction to the 5-T.U. dose, ranging from 8 per 100,000 among those with no induration to 199 among those with 10 mm. or more of induration. The incidence of new disease was highest in late adolescence and early adult life.

In this area of low tuberculosis infection rates, it was not possible to demonstrate any benefit from BCG vaccination during 12 years of observation.

The results of the 5-T.U. tests delineated a high-risk group, namely students with 10 mm. or more of induration. These reactors comprised only 7 percent of the study population, but furnished 80 percent of the cases during the first 5 years of observation.

It is suggested that in areas of low infection rates, which comprise most of the United States today, tuberculosis control programs among school populations might profitably be limited to periodic tuberculin testing surveys, with careful followup of reactors to a low dose.

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A study with followup of 450 persons committed to the Medical Center for Federal Prisoners, Springfield, Mo., revealed that nearly half of 200 defendants referred for examination were found competent, brought to trial, and sentenced. Although nearly 65 percent of a group of 231 persons committed as incompetent later improved under treatment so that they were found competent to stand trial, only 15.2 percent received sentences.

Mental Competency Proceedings in Federal Criminal Cases

CHARLES E. SMITH, M.D., and KENNETH R. STRAWBERRY, M.A.

WHENEVER a person accused of crime is found to be mentally ill, two separate legal questions may be raised. The first relates to the accused's mental capacity to stand trial, receive sentence, and undergo punishment. The second question relates to whether or not the accused is to be considered responsible for his acts. This presentation is concerned solely with the first of these questions, namely, the determination of mental competency to stand trial in Federal criminal cases.

Under Anglo-American common law, mental disorder, amounting to insanity on the part of the accused, is a bar to further proceedings in a criminal case. The application of the common law rule on this issue in the Federal dis-

trict courts is nicely spelled out in the Youtsey case (1), which states, "It is fundamental that an insane person cannot plead to an arraignment, be subjected to a trial, or, after trial receive judgment, or after judgment, undergo punishment." In the Youtsey case the court also appears to have recognized that the attention of a court should be directed to the mental capacity of an accused to understand the proceedings against him, and rationally advise with his counsel as to his defense.

The disposition of the mentally incompetent accused was considered in the Forthofer case (2) which quotes, with approval from Smoot's "Law of Insanity," as follows: "The general practice is that, where the defendant is found to be insane, the trial is stopped pending the prisoner's recovery, and, until he does recover, the prisoner may be remanded to an asylum or other proper form of restraint." In this case the court also pointed out that "At common law a person could not be tried while he was insane, because his helpless condition rendered him incapable of making a proper defense."

The present legislation providing for the care and custody of insane persons charged with, or convicted of, offenses against the United States, was enacted in 1949, Public Law 285 (18 U.S.C. 4244 through 4248) (3). Prior to the enact-

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The study was proposed by Dr. Harold M. Janney, medical director, Bureau of Prisons. The Federal Bureau of Investigation supplied data for the followup study.

ment of this statute, Federal courts dealt with mentally incompetent or insane offenders under the general provisions of the common law.

In 1948 the late George H. Dession prepared a memorandum concerning the proposal for the present legislation in which he attributed the long-standing lack of specific statutory provisions for dealing with the mentally ill Federal offender to several factors. Traditionally, the care and custody of the mentally ill has been regarded as a State and local, rather than a Federal, function. Acceptance of this principle has limited the Federal Government's activities in the care and treatment of the mentally ill to areas which cannot be construed as competing with the States.

Originally, it was felt that the complexity of most Federal offenses tended to preclude the possibility that they would be committed by insane persons. This may have been true when the Federal criminal statutes were limited to offenses which are manifestly direct assaults against the central Government, such as treason and espionage.

However, as the scope of the Federal law has broadened to include such offenses as the white slave traffic act and the interstate transportation of stolen autos, it has become increasingly apparent that there are many Federal statutes which can be violated by mentally ill persons. In fact, a preliminary study (4) of a group of mentally incompetent Federal offenders revealed that some mentally ill persons may be especially prone to become involved in Federal offenses because their illness leads them to carry out acts which are in violation of the Federal law. Mentally ill persons who violated postal laws by depositing scurrilous, threatening, or otherwise objectionable material in the mails were notable examples.

Perhaps the most significant motivation toward the enactment of legislation for dealing with mentally ill offenders is to be found in the changing social attitudes toward mental illness, which have occurred during the past century. There is an increasing trend toward the use of psychiatry in seeking to understand criminal behavior, rather than as a means of avoiding the more severe penalties. Contrary to popular opinion, the psychiatric study of the criminal offender is no longer limited to those cases in

which a capital offense has been committed. Enlightened investigative officers, lawyers, judges, and probation officers are now learning to recognize mental illness when they see it, and no informed person today seriously denies the need for specific statutory provisions for dealing with mentally ill offenders in the Federal courts.

One of the foremost leaders in the development of legislation to deal with the insane Federal offender was James V. Bennett, director of the Federal Bureau of Prisons. In describing the need for a uniform procedure for handling these offenders, Bennett cited "the disturbing number of persons who give evidence of mental unbalance not too long after commitment under sentence" (5). In many of these cases there was considerable evidence to suggest that the offender was mentally incompetent at the time of his trial. The Federal Prison administrator also faced the problem of dealing with the offender who became insane during imprisonment and whose release might endanger the safety of Federal officers or other interests of the United States.

Provisions of the Present Law

To correct these situations, the present law (3) (section 4244) provides that "whenever the United States Attorney has reasonable cause to believe that a person charged with an offense against the United States may be presently insane, or otherwise so mentally incompetent that he is unable to understand the proceedings against him, or to properly assist in his own defense," certain judicial steps shall be taken to determine the defendant's present sanity. If found to be mentally incompetent, the law (section 4246) provides that "the court may commit the accused to the custody of the Attorney General or his authorized representative, until the accused shall be mentally competent to stand trial or until the pending charges against him are disposed of according to law."

Under section 4245 of this law, there is a provision that defendants who have been sentenced, and later found to be mentally incompetent, may be referred back to the court if examination reveals probable cause to believe that such person was mentally incompetent at

the time of his trial, "provided the issue of mental competency was not raised and determined before or during said trial."

Section 4247 of the law provides for the disposition of insane prisoners whose release would probably endanger the safety of the officers, the property, or other interests of the United States. The law, which requires a judicial hearing in cases of this type, states that "if upon such hearing the court shall determine that the conditions specified above exist, the court may commit the prisoner to the custody of the Attorney General or his authorized representative."

In the Federal district courts, the application of the common law test for determining present sanity is set down in some detail in the Chisholm case (6). The issue is stated in this case as whether the accused has "sufficient mental power, and has such understanding of his situation, such coherency of ideas, control of his mental faculties, and the requisite power of memory, as will enable him to testify in his own behalf, if he so desires, and otherwise to properly and intelligently aid his counsel in making a rational defense." The concept is more succinctly stated in the wording of section 4244 which refers to a person "otherwise so mentally incompetent as to be unable to understand the proceedings against him or properly to assist in his own defense."

It should be recognized that the standards for determining "sanity" and mental competency under the criminal law differ from those which are generally applied in civil commitment proceedings. The legal test for determining competency to stand trial is narrower than would be applied in determining the existence of mental illness. Medical definitions of various types of mental disorders are not acceptable legal criteria for incompetency. Within this framework, it is possible for persons to be adjudged legally competent for trial while so mentally ill as to require treatment and even commitment to a mental hospital.

Method and Material

Since the enactment of Public Law 285, the Bureau of Prisons has had a wealth of experience in dealing with persons handled under the

several sections of the act. This paper presents some of the findings made in a statistical study of the clinical records of 200 men committed consecutively to the Medical Center for Federal Prisoners, Springfield, Mo., for psychiatric examination to determine competency to stand trial under provisions of section 4244 of the act and another 250 who were committed consecutively to this institution as incompetent to stand trial under the provisions of section 4246 of the act. The study covers commitments made from 1950 to 1957.

The data tabulated on these men included educational background, marital status, occupation and employment, offense, diagnosis, prior mental illness, prior criminal record, treatment, and disposition.

This data was supplemented with information obtained from followup inquiries made to the courts to which these persons had been returned for disposition and the hospitals to which some patients had been transferred. Finally, the Federal Bureau of Investigation records of a group of patients known to have been returned to the community were examined for evidence of new offenses.

Examination Procedures

All persons committed to the medical center for opinions as to competency receive complete physical, neurological, and psychiatric examinations. Social workers thoroughly explore the patient's background, and his behavior in the hospital is observed by psychiatrists, nurses, and other trained personnel.

We are in agreement with the Menningers (7) that "clinical psychology is essential to the best practice of psychiatry." Nearly 85 percent of our patients received diagnostic psychological examinations which contributed substantially to the overall understanding of these men. It may be assumed that those who were not examined psychologically could be satisfactorily diagnosed without psychodiagnostic evaluation.

The average duration of hospitalization for these examinations was 90 days. In general, the courts have accepted this period of time as necessary for the completion of these examinations. One court has ruled that "some time less

than 90 days is not an unreasonable length of time—to complete a psychiatric examination—and make a report to the committing court” (8).

Our study showed that clear-cut reasons for the referral existed in most cases. Among the reasons for referral for psychiatric study were a history of mental illness, some unusual circumstances surrounding the commission of the offense, or some unusual behavior of the defendant during detention or during his appearance in court. There were cases in which it appeared that psychiatric study was requested when members of the defendant's family or others were unable to understand or accept his criminal behavior. For these men it was desirable to rule out mental illness as a causative factor.

Profile of a Referral Patient

An idea of the kind of individual referred for psychiatric examination to determine competency to stand trial (under section 4244, title 18) can be gained from a profile of the 200 men, constructed of medians and highest frequencies of the various factors considered. Such a hypothetical individual is single, white, and about 30 years of age. He completed a seventh to eighth grade education at the age of 15 years and departed the parental home between the ages of 16 and 17. He has no dependents and lists his occupation as either semiskilled, service, or laboring type of work. The longest period of time spent with any one employer was less than 3 years, and he had four or more jobs in the 10 years prior to his arrest. He resided in from one to three different States during this same 10-year period.

He was involved in some kind of a property crime such as automobile theft, postal theft, or forgery. He is very likely to have had a prior commitment to a mental hospital with a diagnosis of schizophrenia. He has a record of from one to three prior felony arrests, and he may have had one prior penal commitment. He was referred for psychiatric examination either on the basis of a history of mental illness or because of some unusual circumstances surrounding the commission of his offense. He has nearly 7 chances in 10 of being regarded as competent by the psychiatric examiners.

Offenses Committed by Referral Patients

The largest single group of offenders in this series were those charged with violation of the National Motor Vehicle Theft Act. They made up 38 percent of the series. Other property offenses and nonviolent types of offenses, such as mail theft, forgery, fraud, income tax violation, Selective Service law violations, and impersonation, account for 34 percent of the series. Crimes involving assault, or threatened assault, on other persons comprise 28 percent of the series. Included in this group were such offenses as assault, homicide, kidnapping, rape, Mann Act violations, extortion, mailing obscene and threatening letters, and bank and post office robbery.

Well over half of these individuals were involved in interstate movements in the commission of their offenses. Considering the frequency with which bank robbery has been reported in the press in recent years, it is significant to note that 10 percent of the observation patients were charged with this offense, while a little less than 1 percent of all Federal prison commitments are for the offense of bank robbery.

Diagnosis

The staff diagnosed 40.5 percent of the 200 as having some kind of psychotic condition, either functional or organic. Schizophrenia of various types was diagnosed in 28.5 percent of the group. Paranoid psychoses, including paranoid schizophrenia, occurred in 12.5 percent, and 34.5 percent were diagnosed with some type of personality disorder, with 10 percent sociopathic personalities. Neurotic disorder was found in 11 percent of the group, and 9.5 percent were found to be mentally defective.

The high incidence of psychopathology found in this group is an indication that the courts and investigative officers are employing valid criteria in the selection of cases for referral for psychiatric study. Further evidence of the effectiveness of the procedure is to be found in the fact that during the several years that the statute has been in effect, it has been necessary for the director of the Bureau of Prisons to return to the courts as probably incompetent at the time of their trials (under section 4245, title 18) only a few persons.

In a study of the operation of the Briggs law in Massachusetts, Overholser (9) reported that a little less than 16 percent of those examined were found to have some mental abnormality. This law provides for the examination of persons indicted for capital offenses, those indicted for an offense more than once, and those previously convicted of a felony. A comparison of the percentage of psychopathology found in examinations under the Briggs law with that obtained under the Federal procedures suggests that the latter may be a more economical method of separating out the mentally disordered. We believe an additional advantage of the Federal procedure is that its successful application requires a wider participation of law-enforcement people in the psychiatric casefinding process.

Relationship Between Offense and Illness

A preliminary study (4) of mentally incompetent Federal offenders revealed an apparent relationship between illness and offense in the cases of paranoid individuals who had been charged with such crimes as assault, murder, and mailing threatening or otherwise objectionable letters. Statistical analysis of the group of 200 showed that nearly half of those individuals diagnosed with a paranoid disorder, including paranoid schizophrenia, were charged with offenses against persons. Forty-two percent of those diagnosed with some form of schizophrenia were charged with offenses against persons, while only 17.5 percent of those diagnosed with personality disorders were involved in offenses of this type. From these numbers, it may be deduced that nearly one out of every two Federal offenders ill with either a paranoid disorder or schizophrenia will be charged with an offense against a person, while four out of five offenders with personality disorders will be involved in property crimes.

Competency Opinions

Roughly one-third of the observation patients were considered to be incompetent for trial in the opinion of the psychiatric examiners. A little over two-thirds (67 percent) of those

diagnosed as having some form of psychosis were considered to be incompetent. Approximately one-fourth of the 19 mentally defective persons were considered to be incompetent. No sociopathic or antisocial personality types were found to be incompetent. It should be apparent from these findings that a diagnosis of major mental disorder is not always accompanied by an opinion of incompetency.

Disposition

Those men who were regarded as competent by the psychiatric examiners, comprising roughly two-thirds of the group, were all returned to court for disposition of the charges pending against them (fig. 1). Of those who were brought to trial, 49.5 percent of the original 200 received prison sentences. Followup revealed that all but 5 of the 99 sentenced were making a satisfactory adjustment to imprisonment. Other persons who were considered to be competent were either placed on probation or released when the charges were dropped.

Patients found to be incompetent, comprising a third of the total group, were disposed of by hospitalization in State or veterans institutions or recommitted to the medical center under section 4246. Those returned to Springfield comprise 10.5 percent of the original 200.

The Mentally Incompetent Offender

The mentally incompetent offender can be viewed broadly in the results of our study of 250 men committed consecutively to the medical center under provisions of section 4246, title 18. About 40 percent underwent their initial examinations for competency determination as hospital inpatients, some at Springfield. The balance were examined as outpatients in office, clinic, hospital, and jail settings. Less than a third of these 250 offenders received psychological examinations as part of their initial study. Clear-cut reasons for the initial referral for psychiatric study were apparent for all but a few.

Although all these offenders were committed to the medical center as incompetent, the opinion as to incompetency was sustained by the psychiatric examiners at the medical center for a little

less than 80 percent of the group. For the most part, the differing opinions with regard to competency were the result of differences in diagnosis. Experience has shown the benefit of hospital study in difficult cases. As in the observation group, nearly 85 percent received psychological studies at the medical center, which often helped to clarify the diagnosis.

Profile of the Incompetent Offender

We have also assembled a profile of those defendants who were committed as incompetent. The resulting hypothetical incompetent Federal offender is a single, white male about 30 years of age. He left school at the age of 15 after completing approximately the eighth grade. He left the parental home between the ages of 16 and 17. He lists no dependents, and his occupation is either farming, laboring, or service-type work. The longest time spent with any employer was less than 1 year, and he has had four or more jobs in the 10 years preceding his arrest. (One-third of the individuals in this group had no significant employment record.) Our representative offender has resided in several States or in an institution during the 10 years preceding his arrest. The possibilities that he has been charged with an offense involving actual or threatened harm to another person or a property crime are almost equal.

He has a history of prior commitment to a mental hospital with a diagnosis of schizophrenia. He also has a history of three to five prior arrests on felony charges and may have one prior commitment to a penal institution. He has been referred for psychiatric study because of a history of prior mental illness or because of unusual circumstances surrounding his offense. He is likely to have been diagnosed as having some type of schizophrenia (two-thirds of the group) or he has predominantly a paranoid psychosis of one kind or another (one-third). His prognosis is either poor or guarded.

Prior Hospitalization of Offenders

A history of prior hospitalization for mental illness was found in 62.5 percent of the 250, and nearly half of the group had a history of at least one prior penal commitment. Almost 38

percent had been known at some time to a Government-sponsored mental facility, either a military or veterans hospital. Nearly 19 percent of the group had been beneficiaries of the Veterans Administration because of mental disorder.

Offenses and Diagnosis

As in the observation group, the single offense which occurred with the highest frequency was auto theft, comprising 21.9 percent of the series. A total of 56.2 percent were involved in auto theft, other property crimes, and miscellaneous nonviolent offenses. The balance of these individuals (43.8 percent) were charged with offenses which involved either actual or threatened harm to some other person.

For 62.3 percent of these men a diagnosis of some type of schizophrenia was made. Mental deficiency was diagnosed in 5.2 percent and the balance carried various diagnoses including psychotic depressions and organic psychoses. A total of 37.8 percent of the group had psychotic conditions in which paranoid symptoms predominated, including paranoid schizophrenia.

Relationship Between Offense and Illness

In considering possible relationships between diagnosis and offense we found that nearly half (45.4 percent) of the offenses against persons were committed by individuals with some type of paranoid illness. Since nearly 38 percent of the men in this series were diagnosed as having significant paranoid illness, it becomes increasingly apparent that the paranoid individual, in terms of numbers, chronicity of illness, and seriousness of his offense, constitutes a substantial portion of the total problem of the mentally incompetent Federal offender.

Treatment

At the medical center these patients received milieu and the ancillary therapies, individual psychotherapy, insulin coma therapy, electroconvulsive treatment, and tranquilizing drugs, either singly or in combination. In the pre-tranquilizer era nearly 30 percent of the pa-

Figure 1. Disposition by percentage of 200 observation patients referred to the Medical Center for Federal Prisoners under section 4244, Public Law 285

Found incompetent (32)	Transferred to State or V.A. hospital (22)
	Returned to Springfield (10)
Found competent (68)	Sentenced to prison (50)
	Received probation (10)
	Released after hearing (4) Released without hearing (4)

tients received either electroconvulsive or insulin coma treatment. With the introduction of the tranquilizing drugs at the medical center in 1954, use of the physical treatments declined. They are administered to only a few patients, while the drugs are given to about 30 percent of the patients. In substance, it appears that the same types of patients who were treated earlier with the physical therapies have been more recently treated with the drugs.

The rates of recovery and the duration of hospitalization for recovered patients during the period when the physical therapies were in use have not differed markedly from those during the period when tranquilizing drugs were employed. For instance, half of the schizophrenics committed in 1951 recovered sufficiently to be returned for trial during an average period of hospitalization of 217 days. On the other hand, a little over one-third of the schizophrenics admitted during 1956 recovered sufficiently to be returned for trial within an average period of hospitalization of 321 days. Differences between the results obtained during

these 2 years can be readily explained on the basis of differences in the chronicity of the illness of persons admitted during these years, there being more chronically ill patients admitted during 1956.

Leaving aside differences in recovery rates which are known to occur in different classes of illness, the results of our study offer incontrovertible evidence that severely mentally ill persons awaiting trial can be successfully treated. To those who theorize that poor motivation will impede the recovery of such patients, our results may seem to be something of a paradox.

Disposition

Studies of the first 231 persons, all of whom had been followed for 1 year or more, showed that 64.5 percent were returned to court as competent (fig. 2). However, only about half of the 231 were brought to trial. The end result was that 15.2 percent of the group received sentences, 9.1 percent were placed on probation,

Figure 2. Disposition by percentage of 231 mentally incompetent offenders followed for 1 year or more who were referred to the Medical Center for Federal Prisoners under section 4246, Public Law 285

Returned to court as competent (65)	Sentenced to prison (15)
	Acquitted, insane at time of offense (26)
	Received probation (9)
	Released without trial (11)
	Hospitalized - State or V.A. facility (4)
Remained incompetent (35)	Transferred to State or V.A. hospital (33)
	Remained at Springfield (2)

and 10.9 percent were released without a trial. Nearly 40 percent of those returned to court as competent were acquitted by reason of insanity at the time of the offense.

One-third of the 231 patients were eventually transferred from Springfield to various mental hospitals in their States of residence when they failed to improve sufficiently under treatment to be regarded as competent. At the time this was written only a handful of the original group of 231 remained at Springfield.

Our records show that 86 of the 231 were transferred to State hospitals, 77 from Springfield and another 9 under arrangements made by the courts. At the time this report was prepared, 44 of these 86 men remained in State hospitals, 31 had been released from these hospitals, and 11 were reported as eloped or escaped. For many of these men the period of hospitalization was relatively brief.

All but 18 of the 86 who were transferred to State hospitals had some form of schizophrenia. Thirty-nine had paranoid schizophrenia, and

one was diagnosed as having a paranoid psychosis other than schizophrenia. Of the 40 with paranoid psychoses, 23 remained in the hospital at the time this report was written.

Subsequent Arrests and Hospitalization

An examination of the current Federal Bureau of Investigation records of 183 persons known to have been released revealed that 23 percent had been rearrested within 1 year. These records showed that another 13 percent had been rearrested within a period of 2 to 4 years of their release. In addition, the FBI records showed 15 percent were readmitted to a mental hospital over a 5-year period. It is probable that there were other hospital readmissions which were not recorded in these records. From these numbers it is apparent that a very substantial number of these men will continue to be known to police and hospital authorities.

Several interesting things were noted in our study of the subsequent records of the 67 indi-

viduals who had been rearrested following their release from Federal custody. In nearly every instance, the new offense was similar to the offense for which the man had been previously arrested. Eight, or 12 percent, were charged with offenses which involved direct assaults against other persons. All but one of these eight had previously been diagnosed as having some type of schizophrenia, three having been diagnosed as paranoid schizophrenics.

Two of the rearrests were on charges of murder. One of those charged with murder had been previously diagnosed as having simple schizophrenia and the other was diagnosed as a psychopathic personality with psychotic reaction.

In checking on the paranoid schizophrenics who had been charged with offenses against persons, it was found that most of them continued to be hospitalized. While these results show a relatively high rate of recidivism among the mentally ill offenders, it appears that the community is being reasonably well safeguarded from further depredations by those mentally ill offenders who are known to be of the most dangerous type.

Comment

Weihofen (10) has stated that "any reform in the method of trying persons alleged to be insane probably will come through perfecting means for preventing the trial of mentally diseased and deficient persons." Overholser (11) has stated that "we should look to the development of practices on the part of the legal-medical professions which will, so far as possible, avoid not only bias and venality, but the suspicion of them." The Federal statutes are designed to achieve these desirable goals. They provide for impartial psychiatric examinations which prevent incompetent defendants from being subjected to trial and punishment.

About 20 years ago Dession (12) stated "All too frequently the comprehensive and searching picture of an offender revealed by psychiatric case history and diagnosis will serve chiefly to bring out in bold relief the essentially primitive character of all alternatives open for his disposition within existing institutional frames." Today, the proper disposi-

tion of the mentally ill offender remains a complex problem. Offenders with residual mental illness may be adjudged legally sane and then released into the community following a finding of not guilty by reason of insanity at the time of the offense. Some mentally ill offenders are returned to the community prematurely, after having been disposed of as too ill to appear for trial.

Treatment programs for the so-called criminally insane have been neglected. Duval (13) has stated that "the development of new programs in the treatment of criminally insane depends largely on community understanding for its ultimate success."

We believe that the disposition of these difficult cases will be facilitated as psychiatrists and lawyers gain a better understanding of their joint responsibilities in this field. Familiarity with the law and its philosophy will enable psychiatrists to make recommendations which are realistic and feasible within the legal framework governing the disposition of a given case.

In addition, lawyers need to know more about the nature of mental illness. They must know enough about psychiatry to be able to recognize that the concept of "legal sanity" is not always synonymous with that of good mental health. Recognition of shortcomings in the legal provisions by both lawyers and psychiatrists can lead the way toward constructive reforms.

Facilities for the effective treatment of the mentally ill offender must be expanded. It is likely that rates of recidivism in this group could be reduced by providing followup services to insure necessary treatment either as an outpatient or an inpatient, as the person may require.

Summary

The broadening scope of Federal criminal statutes and growing enlightened interest in the mentally ill has led to the enactment of legislation providing for the care and custody of insane persons charged with or convicted of offenses against the United States. These provisions are designed to prevent the trial and sentencing of mentally incompetent offenders.

This paper presents some of the results of a comprehensive study of 200 men committed to the Medical Center for Federal Prisoners, Springfield, Mo., for psychiatric examination to determine competency to stand trial; and another 250 who were committed to this institution as incompetent to stand trial.

Our studies show that Federal courts order psychiatric examinations to determine competency in the cases of individuals charged with a wide variety of offenses, ranging from homicide to forgery to auto theft. Some socioeconomic characteristics of mentally ill offenders are presented.

Significant psychopathology was found in a large percentage of those referred for psychiatric study, with 40.5 percent diagnosed as actively psychotic. Nearly half (49.5 percent) of the defendants who were referred for examination to determine competency were later brought to trial and received sentences.

It was found that many defendants who are committed as incompetent, pending trial for their offenses, can be improved under treatment so that they are competent to stand trial. In this series, nearly 65 percent of those who had been declared incompetent were eventually returned to court for trial, with 15 percent receiving sentences.

Defendants suffering with paranoid illnesses constitute a substantial portion of the total problem of the mentally incompetent Federal offender, in terms of numbers, chronicity of their illness, and seriousness of their offenses. These individuals are prone to commit offenses against persons. The procedures which are being followed in the disposition of these men operate to protect the community against the further depredations of these more dangerous types of mentally ill offenders.

Followup studies suggest the need for increased facilities for the hospital treatment and aftercare of mentally ill offenders. There are indications that some mentally ill offenders are returned to the community prematurely after

having been disposed of as too ill to appear for trial.

Lawyers and psychiatrists must continue to work together for mutual understanding in fulfilling their joint responsibilities in arranging for the effective disposition of the mentally ill offender. In accomplishing this goal, it is important to recognize that the concept of "legal sanity" is not always synonymous with a state of good mental health.

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Rehabilitation Care in Nursing Homes

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DEMONSTRATION of the value of rehabilitation nursing of elderly patients in nursing homes was the object of a 1-year project in Minneapolis in 1958-59. The project was the outgrowth of an earlier and still continuing educational and surveillance program of the Minneapolis Health Department and of the interest of the Kenny Institute in wider use of its rehabilitation nursing techniques.

For several years, the Minneapolis Health Department has been conducting a vigorous surveillance and educational program in the city's nursing homes, under deputized authority from the Minnesota Department of Health. Minneapolis, a city of approximately 527,000 people, has 65 licensed nursing homes with a total of 2,632 beds. Eleven of these homes, with a total of approximately 870 beds, are for elderly well people. Forty homes are under the guidance of nurses-in-charge who are registered nurses; the remainder are supervised by licensed practical nurses.

All nursing homes in Minneapolis are visited on an average of nine times a year, and, at each visit, the emphasis is on helping the administrators and nurses. Various grading systems have been tried and revised. The most useful is that currently in use, the "Minneapolis Scoring System" (1). This system has made it possible to measure progress and to pinpoint the areas where improvements are needed.

Educational Program

Early in the educational program it was recognized that many defects and deficiencies in nursing homes were being perpetuated because neither the nursing staff nor the nursing home administrators knew how to do a better job. The philosophy that the aged were in the homes

simply to wait for death was all too common, and little effort was being made to improve the health of the patients or their enjoyment of the time remaining to them. If nursing care was to improve, nurses' aides needed some training either through inservice training or through some outside program. Also, the nurses-in-charge needed a much better appreciation of their responsibilities for supervising nurses' aides, controlling medicines and treatments, contacting and informing attending physicians about their patients, obtaining up-to-date doctors' orders, and keeping accurate and meaningful records. All this added up to a crying need for training at all levels.

At the beginning of the program classes were held in various nursing homes, and the nursing staffs from neighboring homes were invited. The number of persons wishing to participate quickly mounted to more than 100, and it was realized that fewer people and longer sessions would be more practical. A room equipped with a hospital bed and bedside nursing equipment was set aside in the public health center as a classroom. Teaching charts were prepared, and a 2-day course in basic nursing was designed. Classes, limited to about 20 students by an advance appointment system, are being conducted 2 days a week, with the same nurses' aides attending both days. Each aide is provided with an experience record card on which

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each of the more than 50 procedures taught is initialed by the teacher. After the aide has demonstrated satisfactory performance of a procedure, the nursing home supervisor initials the item. This card, certifying the aide's degree of proficiency, is a valuable document, which she can show to her employer or to any future employer.

The cooperation of the nursing homes, hospitals, doctors, and nurses has been excellent, and outstanding progress has been made (2-5).

Kenny Institute

In 1957 the medical staff of the Kenny Institute in Minneapolis became interested in extending their rehabilitation nursing techniques to a larger number of handicapped people. The staff felt that hospitals, nursing homes, and public health officials might be interested in such a project. The institute set up a series of 1½-day classes, and representatives of these groups were invited to attend.

The Minneapolis Health Department was quick to realize the contribution which the Kenny Institute could make to rehabilitation nursing. With assistance from the Kenny Foundation, arrangements were made to send two nurses at a time from the combined nursing service of the health department and the Visiting Nurse Service to work on the wards of the institute for 10- to 12-week intervals. The health department felt that nurses so trained, when attending patients in their homes, would apply and teach patients and their families the nursing techniques used at the Kenny Institute, with primary emphasis on maintaining remaining muscle function and on prevention of unnecessary contractures. By the time the health department was prepared to embark on a demonstration of rehabilitation nursing in nursing homes in October 1958, 8 or 10 nurses in the combined nursing service had had the Kenny Institute experience.

Rehabilitation Nursing Project

Early in 1958 the health department undertook an extensive educational program for nursing home administrators and their nursing staffs. The acceptance of the program was

very gratifying, and it was challenging to find that nursing home personnel wanted to do a better job of caring for their patients and were only too anxious to learn how to accomplish it.

In the fall the commissioner of health for Minneapolis authorized a 1-year demonstration project in rehabilitation nursing in nursing homes, which would be supplemental to the established surveillance and educational program. Six public health nurses who had completed their work on the wards of the Kenny Institute were assigned to work with and under the immediate supervision of the nurse adviser for rest homes for one-half day per week.

The important but simple booklet "Strike Back at Stroke" (6) illustrates techniques of handling partially paralyzed people which are very similar to those employed by the Kenny Institute. This publication, along with "How to be a Nursing Aide in a Nursing Home" (7), teaching guides used by the Kenny Institute, the Minneapolis General Hospital, and the American National Red Cross, and other books on rehabilitation nursing provided background and reference materials.

The project was organized and guidelines outlined through consultations among the leading participants and supervisors of the combined nursing service.

Anticipated Benefits

It was anticipated that the program would demonstrate that some patients in nursing homes would be restored to self-sufficiency or made much more self-sufficient.

It was also anticipated that the program would provide other benefits, such as:

- Improvement in the general quality of nursing care.
- Recognition by the nursing home of the value of regular inservice training and establishment of a desire to continue such training.
- Improvement in the general morale of the nursing staff.
- Improvement in the general atmosphere of the nursing home and in the morale of the patients.
- Upgrading of the home as a result of improvements resulting from participation in the project.

- Beneficial publicity for the home.
- Improvement in public relations.
- Stimulation of other nursing homes to make improvements in their homes, in order to maintain their competitive positions.
- Benefits to participating members of the Minneapolis combined nursing service from the teaching experience gained.
- Additional impetus and recognition received by the Minneapolis Health Department.
- Greater appreciation by training schools for nurses and practical nurses of the need for more trained people in nursing homes.
- Recognition by nursing home associations of the value of cooperative inservice training, leading them to undertake to develop and maintain teaching programs of their own.

Groundwork

The proposed demonstration was explained in detail to groups which might be interested in or affected by it. Letters describing the project were sent to the president and the executive secretary of the Hennepin County Medical Society, and the society's Committee on Nursing Homes. The board of directors of the medical society subsequently enthusiastically approved the project. Letters were also sent to the Minnesota Department of Health, the Minnesota Board of Nursing, and the Minnesota Department of Education, explaining the project and assuring them that no attempt would be made to issue diplomas nor to interfere in any way with their regular teaching and licensing procedures.

Meetings were held with the supervisory staff of the Kenny Institute and the executive staff of Hennepin County Welfare Board. At a regular meeting of the Twin City Nursing Home Association the project was explained fully and the approval and moral support of the association were obtained. The Twin City Nursing Home Association was advised that the commissioner of health proposed to place the participating homes in competition and to award a citation to the nursing home making the most improvement during each competition period. The county welfare board agreed to cooperate in the appraisal of patients and not to reduce payments to nursing homes for any

patient given intensive rehabilitation nursing, until the end of the demonstration period, no matter how self-sufficient the patient became.

Project Design

The demonstration was designed to operate in six nursing homes for 6 months and to transfer to six other nursing homes for a second 6 months. The procedures followed were the same in both groups of homes.

Six participating homes were chosen, and one public health nurse was assigned to work in each home for the same half-day each week. The homes selected were all about the same size, the quality of service provided was similar, and the patients were of the same type and age. Patients with disabilities and limitations were chosen for rehabilitation nursing without regard to their prospects of benefiting from the techniques. Six or more nursing homes similar in size and comparable in type of patients to the participating homes were selected as controls. One home for the aged was included in each group. Nurses were not assigned to work in the control homes, but the homes were evaluated on the same basis as the participating homes. In both participating and control homes the nurse adviser explained the project fully to administrators and nurses-in-charge and obtained their cooperation.

The nurse adviser and the county welfare worker jointly selected and appraised individual patients for intensive rehabilitation nursing in the participating homes and selected similar patients in the control homes. Both participating and control patients were elderly and were suffering from disabilities resulting from strokes, old fractures, arteriosclerosis, paralysis agitans, arthritis, amputations, and so on.

For each patient selected in the participating homes, the nurse adviser obtained the approval of the attending physician and the consent of the patient's relatives for him to receive intensive rehabilitation nursing care. Whenever possible, personal interviews were held with the physician, at which time the project was explained fully and his support obtained. When a personal interview could not be arranged, the evaluations were sent to the physician for

NURSING HOME IMPROVEMENT EVALUATION RECORD

Name of home..... Address..... Phone.....
Superintendent or manager..... Nurse in charge..... LPN, RN (encircle)
Doctor on call..... Phone..... Number of patients by license.....
Number on nursing staff at start..... 3 months..... 6 months.....

Evaluation Rating: 1—Unsatisfactory, 2—Satisfactory, 3—Good

Nurse in charge		Start			3 months			6 months		
Number	Item	1	2	3	1	2	3	1	2	3
1.	Is she given necessary authority to function well?									
2.	Is she well informed and interested in learning?									
3.	Does she assign duties specifically and fairly?									
4.	Are job classifications set up for staff?									
5.	Is Kardex kept up accurately?									
6.	Is the diagnosis of each patient clearly defined?									
7.	Does she evaluate doctor's orders regularly?									
8.	Are drug effects known and recognized?									
9.	Is staff given adequate instruction?									
10.	Does she participate in an active staff training program?									
11.	Does she hold regular staff conferences?									

Nursing Staff

1.	Care of bed patient with frequent change of position.									
2.	Care of seriously ill.									
3.	Is total patient care understood? Adjusting environment to encourage self-help.									
4.	Are total patient's needs supplied?									
5.	Does staff understand what constitutes good patient position?									
6.	Are body mechanics understood in this home?									
7.	Is rehabilitation understood?									
8.	Is any intensive nursing therapy practiced?									
9.	Is preventive therapy emphasized?									
10.	Does staff understand what is meant by preventable conditions?									
11.	Are nursing measures used to prevent contractures?									
12.	Are bedsores given prompt regular care?									
13.	Are incontinent patients given bedpan or urinal regularly?									
14.	Is the patient given training in bowel control?									
15.	Does staff understand the meaning and effect of stroke, senility, heart disease and similar diagnosis?									

his verification and signature, and he authorized the type of care to be given the patient or specified certain limitations of care.

Patients were evaluated before the demonstration began, at the end of 3 months, and at the end of 6 months.

The public health nurses, under the direction of the nurse adviser, conducted teaching programs in the nursing homes participating in the demonstration. The nurse-in-charge and the nurses' aides gathered around the selected patients and the public health nurse taught and demonstrated rehabilitation nursing techniques. Among items covered were

muscle and joint movements, placement in bed, use of footboards, techniques of getting in and out of bed, use of wheelchairs, crutches, and appliances, self-help in dressing, walking, bowel and bladder training, patient motivation, and so on. The nursing home staff was expected to continue working with the selected patients throughout the 6-month period, with the guidance and stimulation of the public health nurse.

During the demonstration, the nurse adviser continued the regular educational program begun early in 1958 for all nursing home administrators and their staffs without particular

Nursing Staff—Continued

Number	Item	Start			3 months			6 months		
		1	2	3	1	2	3	1	2	3
16.	Is patient teaching practiced with emphasis on aid to daily living?									
17.	Does staff have a healthy attitude toward the aging?									
18.	Is each patient approached with a positive attitude toward rehabilitation?									
19.	Does staff understand doctor's order as to patient's limitation?									
20.	Can staff interpret doctor's orders as to "within pain limits"?									
21.	Does staff know which exercises they must do and those which a patient can do?									
22.	Are basic principles carried out in making up a bed for a rehabilitation patient?									
23.	Does staff know how to:									
	a. Assist a patient to a sitting position?									
	b. Transfer a patient from a bed to a wheelchair?									
	c. Propel a wheelchair?									
	d. Transfer from wheelchair to bed?									
	e. Wheelchair to toilet?									
	f. Transfer from wheelchair to bathtub?									
	g. Transfer from wheelchair to armchair?									
24.	Does staff carry out active or passive exercise?									
25.	Does bedside care include "range of motion"?									
26.	Is home interested in our Home Improvement Program?									
27.	Are extra classes incorporated to make staff better qualified to share this program?									
28.	Have any reference books been added for staff education?									
29.	Morale of nursing staff.									
30.	Is patient contentment and well-being affected?									
31.	General level of care provided in home.									
32.	Equipment to carry out rehabilitative measures more effectively.									

List equipment added

Remarks:

emphasis on the nursing homes in the demonstration project, except as she worked with and supervised the six public health nurses assigned to the participating homes.

To stimulate competition and promote publicity, awards were promised to the nursing homes making the most improvement during the demonstration period. The awards were in the form of framed embossed citations which the nursing homes could hang for public display. The awards were presented at regular meetings of the Twin City Nursing Home Association, and the local newspaper carried news items regarding them.

Evaluations

All evaluations of participating patients and control patients were made jointly by the nurse adviser and a county welfare worker. The original evaluations, and in most instances the final evaluations as well, were verified by the attending physician. The evaluation form provided a choice of three columns for recording each patient's status. These columns were headed "Total care," "Needs help," and "No help." A fourth column was headed "Remarks." Items were grouped under such broad areas as bed status, mobility, personal needs, dressing, continence, mental condition, and

motivation. The letter S was inserted in the appropriate column opposite the item to designate the patient's status at the start, the figure 3 to designate the 3-month evaluation, and the figure 6 to designate the 6-month evaluation. The doctor's order sheet was attached to the evaluation form.

The effect of rehabilitation nursing on selected patients is shown in table 1. Table 2 shows the status of the control patients at the end of the demonstration. In table 3, total changes are expressed in percentages after eliminating patients who died or were transferred to other facilities and those who became worse due to natural deterioration.

While less than 50 percent of the patients receiving intensive rehabilitation nursing were benefited, nevertheless, about 30 percent showed significantly more improvement than the control group (table 3). This accomplishment is all the more significant when it is realized how unpromising some nursing home patients are and that no physiotherapy was used. The following cases illustrate some of the accomplishments.

One elderly lady who had had a stroke in 1949 and had fractured her hip in 1950 had been bedridden ever since and was only out of bed when lifted. After intensive care, she was able to transfer from bed to wheelchair with little help, operate the wheelchair alone, dress herself, and is now living a much happier life.

An inoperable cancer patient who was pre-

viously bedfast and receiving complete care became entirely self-sufficient, up and dressed every day, walking about with an air of dignity and self-respect not previously manifested.

With a patient who was fearful and resistant, the indirect approach worked out very well. Mrs. A was an elderly leg amputee who had been a total care patient for about 2 years. She had been out of bed and in a wheelchair only when lifted by nurses. Her doctor said she could be up and about on crutches if she wanted to. She refused to try any exercises so another leg amputee was placed in the room with her. Rehabilitation nursing techniques were carried out on her roommate. Surreptitiously Mrs. A began doing the exercises she saw her roommate doing and eventually she became largely self-sufficient. Mrs. A improved to the extent that she left the nursing home and went by airplane to live with her daughter in California.

The following comment from a nurse's letter speaks for itself: "It is a good feeling to see patients come into our home unable to move their extremities on one side and one day see them walk down the hall with little or no assistance."

One public health nurse, reporting on the home she served, wrote "All the nurses have a good knowledge of the range of motion exercises, wheelchair transfer, and other rehabilitative nursing procedures. They are proud of the fact that not one bedpan is used, that all

Table 1. Status of patients given intensive rehabilitation nursing care at end of demonstration

Nursing home	Number patients at start of demonstration	Number patients followed throughout	Number patients by changes					
			Transferred	Died	Worse	No change	Better	Markedly better
1-----	7	7	0	0	0	1	3	3
2-----	4	4	0	0	0	3	0	1
3-----	9	8	0	1	1	6	1	0
4-----	8	6	1	1	0	5	1	0
5-----	7	6	0	1	1	4	0	1
6-----	5	5	0	0	1	2	2	0
7-----	12	12	0	0	0	3	4	5
8-----	5	5	0	0	0	2	1	2
9-----	9	9	0	0	0	6	2	1
10-----	8	8	0	0	0	3	3	2
11-----	7	7	0	0	1	1	4	1
12-----	6	5	0	1	0	4	1	0
Total-----	87	82	1	4	4	40	22	16

Table 2. Status of control patients at end of demonstration

Nursing home	Number patients at start of demonstration	Number patients followed throughout	Number patients by changes					Markedly better
			Transferred	Died	Worse	No change	Better	
1-----	2	2	0	0	0	1	1	0
2-----	4	4	0	0	0	2	1	1
3-----	7	7	0	0	0	4	3	0
4-----	6	5	0	1	0	4	1	0
5-----	5	4	1	0	0	4	0	0
6-----	4	2	0	2	0	1	1	0
7-----	10	5	4	1	0	5	0	0
8-----	12	11	1	0	0	11	0	0
9-----	12	10	0	2	2	8	0	0
10-----	10	8	1	1	0	8	0	0
11-----	6	5	0	1	0	2	3	0
12-----	8	5	1	2	0	5	0	0
13-----	5	5	0	0	0	3	1	1
Total-----	91	73	8	10	2	58	11	2

of the patients get up and dress during the day and everyone gets a tub bath. The working morale is excellent and this is reflected in their attitudes toward the patients."

The impact of the demonstration program on the participating homes was measured in many different ways, and the same evaluations were applied to the control homes. Eight scoring items were used in evaluating the homes in competition for the awards. The criteria used were: purchase of hospital room furnishings, such as beds, mattresses, bedside tables; evaluation of functions of the nurse-in-charge and functions of the nursing staff in the three categories—unsatisfactory, satisfactory, good or excellent—scored at the beginning of the demonstration and at the end of 3 months and 6 months; attainment count, based on the evaluation record; narrative comment; patient improvement; participation in instruction classes; redecorating building; and purchase of equipment, especially for the use of nurses, such as manuals, teaching aids, and filing equipment.

The most important of the evaluation forms was the Nursing Home Improvement Evaluation Record (p. 608). This form provides a checklist which was used by the nurse adviser at the start, at the 3-month interval, and at the end of the 6-month period, and was chiefly concerned with the impact of the program on the nursing staff. On the form, the nurse-in-charge was rated unsatisfactory, satisfactory,

or good on 11 items and the nursing staff on 32 items.

Competition was keen among the participating nursing homes. During the first 6-month period, five homes chalked up creditable scores, with one winning the award citation. During the second 6-month period, three nursing homes ran so closely together, and away out in front, that each was awarded a citation.

Conclusions

The rehabilitation nursing demonstration was so successful that all of the objectives and anticipated benefits were accomplished except the increased appreciation of training schools of the need for more trained people in nursing homes, and recognition by nursing home associations of the value of cooperative inservice

Table 3. Percentage of change among patients followed¹

Category	Number	No change (percent)	Better (percent)	Markedly better (percent)
Participating---	78	51.3	28.2	20.5
Control-----	71	81.7	15.5	2.8
Net improvement-----			12.7	17.7

¹ Exclusive of patients who died or became worse.

training and development and maintenance of teaching programs. However, further developments may take place in these two areas.

The impact of the demonstration project on most of the participating nursing homes was markedly evident, as manifested in better nursing service, better morale among both staff and patients, and striking improvements in the physical appearance of the homes.

Some benefits were not entirely foreseen. For instance, getting people up during the day and the marked success in bowel and bladder training reduced the amount of laundry, practically eliminated bedsores, and greatly reduced the back care and bedpan service falling on the unpopular 3 to 11 p.m. nursing shift. Nursing staff became more stabilized, nurses more interested in further training and in using reference books. Nurses began to see the real function of occupational therapy as practiced by registered therapists. Even nursing homes outside of the demonstration project began to increase their emphasis on occupational therapy, to participate more fully in educational opportunities, and to build up their own nurses' reference libraries. In the participating homes a spirit of optimism was evident everywhere and was justified by the successful efforts of the patients to help themselves and to participate in more communal living.

The demonstration itself, and the publicity associated with the granting of awards, had a stimulating effect on all the nursing homes in the city, and interest in improving them was definitely deepened. The demonstration also served to dispel part of the pessimistic attitude of doctors, nurses, and relatives toward patients in nursing homes.

The demonstration substantiated the belief that the Kenny Institute's rehabilitation nursing techniques and other similar published rehabilitation nursing techniques can be learned and applied by nursing staffs in nursing homes.

Experience showed that acceptance of the principles of rehabilitation nursing and the enthusiasm of the nurse-in-charge were the factors of primary importance.

The study also showed that intelligent nurses' aides can carry out the techniques after they have been given some grounding in basic nursing, an elementary description of each patient's

physical and mental condition, and taught specifically what to do for each patient.

The nurses' aide should have ready access to a supervising nurse or a consultant who has had special training in rehabilitation nursing. The on-the-ward training at Kenny Institute does provide that needed training, but careful reading of written and illustrated materials such as "Strike Back at Stroke" (6) and many others also gives sufficient guidance when combined with knowledge of the patient's condition and specific doctor's orders.

The demonstration showed that much can be accomplished in preservation of function and restoration of activity within the framework of nursing techniques without infringing on the field of physical therapy. This has real significance in view of the severe shortage of trained physical therapists.

The patients under study received no physiotherapy but were given intensive rehabilitation nursing care such as is practiced at the Kenny Institute in Minneapolis and by other rehabilitation centers. The study showed significant improvement in 48.7 percent of the patients given intensive care as compared with 18.3 percent of the control patients.

The impact on the participating nursing homes was even more significant. Under the scoring system used, the average number of points scored by the 12 participating homes out of a possible 294 was 126.5, with a high of 188.5 as compared with an average of 48.7 points, and a high of 91.5 by the 12 control homes. While it is admittedly difficult to measure improvement mathematically, there can be no doubt about the tremendous improvement which took place in the majority of the nursing homes which participated in the demonstration project.

Future plans of the Minneapolis Health Department include the continued promotion and teaching of rehabilitation nursing as a part of the already established educational program in Minneapolis nursing homes. This will require one additional nurse but the benefits will be available to all nursing homes in the city on a continuing basis.

The demonstration of rehabilitation nursing was conducted by the Minneapolis Health Department and extended over a period of 1

year. During that time, intensive rehabilitation nursing was demonstrated in 12 nursing homes on selected patients with the authorization of the patients' own physicians. The impact of the program on 78 individual patients was measured and compared with 71 control patients who were followed during the same period. The impact of the program on the 12 participating nursing homes was also evaluated and compared with 12 control homes, similarly evaluated.

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films

The Nurse Epidemiologist

35-mm. filmstrip, color, sound, 95 frames, 14 minutes, cleared for television, 1959. (Order No. F-361.)

Audience: Hospital and public health nurses, nursing students, and allied personnel.

This filmstrip outlines the knowledge, duties, and responsibilities of the public health nurse in an epidemiological investigation, including sequences on identification of specific epidemiological patterns of time, place, and persons; the spread

of pathogenic organisms; how disease organisms reach the various portals of entry; and chronological order of the nurse's duties during an investigation.

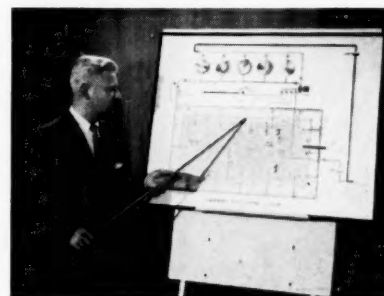
Prints are available on short-term loan, United States only, from the Communicable Disease Center, Public Health Service, Post Office Box 185, Chamblee, Ga. They can be purchased from United World Films, Inc., 1445 Park Ave., New York 29, N.Y., list price \$9.10.

Introduction to Swimming Pool Sanitation

16-mm. motion picture, color, sound, 23½ minutes, 846 feet, 1959, not cleared for television. (Order No. M-402.)

Audience: Public health personnel, pool operators, environmental hygienists, and others concerned with swimming pool sanitation.

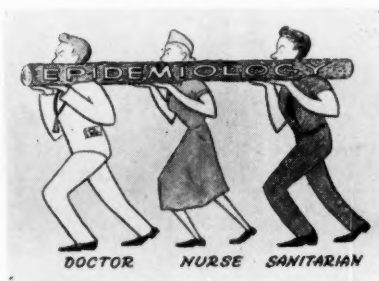
An introductory lecture for courses in swimming pool sanitation, the film uses as a guide the introductory lecture given on pages 15-21 of the manual "Swimming



Pools—Disease Control Through Proper Design and Operation." It previews the course by summarizing the field that will be dealt with, that is, design, layout, and operation.

The film can be used as an aid for organizing scheduled lectures. It shows how to use the "Swimming Pool Sanitation Color Charts," and suggests training aids for the presentation.

It is available for purchase, \$179.17 list, from United World Films, Inc., 1445 Park Ave., New York 29, N.Y., or obtained on short-term loan (United States only), from the Communicable Disease Center, Public Health Service, Post Office Box 185, Chamblee, Ga.



Legal note . . . Protection Against Radiation Hazards

City held without authority, in exercise of police power, to prohibit licensee of Atomic Energy Commission from conducting business of collecting, packaging, and disposing of radioactive wastes at sea, on ground that Federal Government had preempted the field of protection of health against radiation hazard from such materials. (*Boswell v. City of Long Beach*, Cal. Super. Ct., 28 L.W. 2481, March 21, 1960.)

Plaintiff, who was licensed by the Atomic Energy Commission to collect, package, and dispose of radioactive waste material by dumping it at sea, had contracted with two AEC licensed laboratories in northern California to dispose of their radioactive waste. He applied for and complied with all requirements of the City of Long Beach for a license to engage in this business on property located within the city. Although the application was in fact approved by all the city departments concerned, including the health department, and the license fee was paid, the actual license was never issued. When the first shipments of radioactive materials arrived at plaintiff's premises, city police prevented unloading of the waste, the health department withdrew its approval, the license fee was refunded, and a criminal prosecution instituted against the plaintiff for engaging in business without a city license. Plaintiff then brought this action to restrain the city and its officers from interfering with the conduct of his business. The court granted the injunction, holding that the city could not prohibit the plaintiff's activities conducted in accordance with the terms and conditions of his license from the AEC.

In opposing the injunction, the city relied on two grounds: that plaintiff's business violated a zoning ordinance and the protection of the public health.

The city contended that plaintiff's operation constituted a junk business, which was prohibited in the city by the zoning ordinance. The court noted that the record showed a finding that plaintiff's business was permitted by the ordinance and that, despite the failure to issue a formal license, the plaintiff was in fact duly licensed. The procedure followed by the city in its attempt to withdraw the license, without just cause or notice and hearing, was therefore arbitrary and unauthorized.

The court commented that, on the merits, it was doubtful that the business could be classified as a junk business, but found it unnecessary to decide the question since in its view the city was powerless to

stop the operation "by zoning or any other exercise of the police power."

Turning to the second ground urged by the city—the protection of the public health—the court held that the Atomic Energy Act of 1954 (42 U.S.C. 2011 et seq.) had fully occupied "the entire field of atomic energy legislation, including protection of public health and disposal of radioactive wastes." The court pointed out that section 2021 (added to the act by P.L. 86-373, enacted September 23, 1959), authorizing cooperation with the States by the Atomic Energy Commission in the regulation of by-product, source, and special nuclear materials, specifically prohibits the Commission from discontinuing its authority and responsibility with respect to the disposal into the ocean or sea of wastes from such material.

Finding that the Federal statute clearly occupied the field of atomic energy and "particularly the matter of radioactive waste disposal and public health problems incident thereto" the court held that the attempted absolute prohibition of the plaintiff's activities, which were licensed and supervised by the AEC, was unreasonable and beyond the power of the city.

This did not, in the court's opinion, mean that the people of the city were without protection against radiation hazards (created by AEC licensees), but merely that such protection must be afforded by the Atomic Energy Commission. Moreover, the court noted, licensees of the Commission are not exempt from local regulations which do not unreasonably interfere with or frustrate the national objectives committed to the exclusive jurisdiction of the Commission. (42 U.S.C. 2021(k) provides: "Nothing in this section shall be construed to affect the authority of any State or local agency to regulate activities for purposes other than protection against radiation hazards.")—SIDNEY EDELMAN, *assistant chief, Public Health Division, Office of the General Counsel, Department of Health, Education, and Welfare.*

*Conference
Report*

SMALL PLANT HEALTH SERVICES

Plants with 500 or fewer employees, considered small businesses by Federal definition, are apprehensive of a substantial drain on their resources in any attempt to bring meaningful health services to their employees.

Three papers, presented at a symposium on occupational health held last summer as part of the eighth annual health conference sponsored by the Commonwealth of Pennsylvania Department of Health, reveal some facets of the problem and pertinent actions taken in its solution.

A brief version of each of these papers is given here.

The Mobile Health Survey

brief

Early in 1945, health and welfare officials of the International Ladies' Garment Workers' Union decided that a clinic or health center was needed to serve the members of Local 108. The approximately 1,800 members of this local, the majority of them women, worked in shops or small plants within a radius of 65 miles around Harrisburg, Pa.

Based on a paper by James Bloom, M.D., medical director, Central and Western Pennsylvania District, International Ladies' Garment Workers' Union.

But careful study revealed that the distances to be traveled would make such a center all but inaccessible to the majority of the membership and therefore unjustified. The study report also cited the pattern of care at other existing health centers as being inapplicable to the Harrisburg area.

Several novel and yet untried concepts were embodied in the plan presented to the district headquarters of the union the following year. The most important specified bringing a measure of health service to the people at their places of employment and during working hours.

The plan did not presume to offer compre-

hensive medical service, and there was no thought of replacing the family physician or existing medical facilities. But it would have been unrealistic not to acknowledge that demands for medical services far exceeded the supply of doctors. The proposed plan offered reinforcements to help the doctor do the job confronting him in the community.

A complete and continuing diagnostic survey would require a team composed of a full-time physician, a nurse, possibly a medical secretary to assist with paperwork, and a laboratory technician to perform basic routine studies. It was recognized that the cost of such a survey would be prohibitive. Yet if the plan were to be principally diagnostic in aim, with the objective of assisting and supplementing the work of the family doctor, what service could be given that would be meaningful within the fiscal limitations of the union's resources?

It was decided that a carefully recorded medical history, taken in conjunction with routine laboratory studies, might yield an impressive number of actual, latent, or potential abnormalities. This conviction supplied the basis for the *modus operandi* of the mobile health survey program.

Operating Methods

Supervisory responsibility for the survey is centralized at the district headquarters level of the union, the district medical director controlling the survey program, as he does other medical activities. Home base for the survey teams is in quarters adjacent to the office of the medical director. Each team is composed of two young women, one a medical caseworker and the other a well-trained clinical laboratory technician. To facilitate followup, when employment at the survey site is large, more than one team is used in order to shorten the time interval between visits. The importance of early detection of abnormal conditions needs no elaboration.

The medical department is supported by the staff of the union's district headquarters. Preliminary promotional efforts, liaison duties, and administrative functions are accomplished with their assistance.

In consultation with the local manager of the

union, a schedule of survey visits is arranged. Before the survey begins, the workers at a plant on the schedule are approached as a group at their place of employment. The survey routine is described in detail, the benefits to be derived are explained, and all prospective participants are assured that information obtained as a result of the survey is treated with the utmost confidence. It is stressed that no one has access to the records except the medical director and the employee's own family physician. Participation in the survey is voluntary; there is no coercion, and no pressure, in any form, is brought to bear.

Space is supplied by the employer. Elaborate arrangements are not necessary but one condition is fixed and unvarying—there must be absolute privacy for the employee and the medical caseworker while the employee's history is recorded.

Certain laboratory procedures are routine. The technician does a complete urinalysis (physical, chemical, and microscopic), a blood study which includes hematocrit, hemoglobin, leucocyte, and differential counts, and finally a blood type and Rh factor finding.

When other studies are indicated, they are accomplished. If the leucocyte count is elevated, if history reveals suggestive or presumptive evidence of arthritis, lung pathology, or any acute or chronic malady, a sedimentation test is done. If the hemoglobin or hematocrit is impressively increased or depressed, an erythrocyte count is made. Should the urinalysis disclose glycosuria, or should there be a family history of diabetes, a blood sugar determination is made. Blood sugar tests are made if the patient is overweight and hypertensive, if there is history of excessive water consumption, frequent abscesses, or any similar indication. And if we lack the facilities for any study that seems advisable, arrangements are made to have the study done elsewhere.

Survey teams are not staffed by graduates in medicine. But the medical caseworker has completed a course of training, and has the appropriate personality, poise, and interest in medicine to qualify as a case historian. The professional requirements of a laboratory technician are well known.

We are convinced that presumptive evidence

of many deviations from normal health can be revealed by case histories. The use of a stereotyped form is not permitted. Such a device, we believe, may convey to the patient the impression that the caseworker must resort to the use of a memory aid, thus threatening the patient's confidence and destroying many of the virtues of the more personalized approach. The caseworker knows the object and significance of the history, she knows what questions to ask and why she asks them, and her training and judgment supply the only aids she requires.

Twenty-five minutes is allotted to each interview with the caseworker. In addition to taking a medical history, the caseworker takes the blood pressure and pulse rate and determines visual adequacy, using the telebinocular apparatus.

A tangible, though incidental, byproduct of history-taking is its educational value to the layman. When a patient is asked about a change in bowel habit, the presence of a watery vaginal discharge, night sweats, increased thirst, dyspnea on exertion, or precordial pain, she receives an impression of the importance of these symptoms. It is conceivable that this impression will cause her to consult a physician at once should these symptoms occur at a future date, rather than to procrastinate.

Twelve patients a day can be surveyed by a two-person team working from 6 to 7 hours and using the described technique. During the survey, a day at the plant site is alternated with a day at the home office, where tests are completed, notes taken are transcribed into permanent records, and equipment is prepared for the next day's needs.

Both histories and laboratory reports are reviewed carefully, analyzed, and evaluated by the medical director. Any significant findings suggestive of existing or potential abnormality are noted and reported to the physician designated by the patient. All case studies are classified and processed according to the findings. Appropriate reports are sent to the patient and her physician. Every reasonable effort is made to persuade the patient to consult her physician if there is evidence that she needs or would benefit from his guidance and advice. The physician is invited and encouraged to avail himself of our facilities and resources in

the management of the problem, whatever it may be.

More than 30 percent of the participants show substantial indications which warrant a recommendation of treatment by the family physician.

The program is a continuing one. An effort is made to return a team to each plant once every 18 months on a revolving schedule. But when urgency is indicated, teams return to visit some patients at 3-month intervals or less.

Achievements

Initially the membership served in the vicinity of Harrisburg numbered 1,800. Today, 4 teams, or 8 persons, serve about 6,000 members in an area which has been expanded to include the vicinity of Johnstown.

Facilities now available in Harrisburg permit a member to receive, free of cost, a complete physical examination if it is needed or requested. And a variety of social services are given from time to time.

Member participation in the survey has increased to more than 80 percent.

In 13 years of operation in 16 counties of Pennsylvania more than 1,300 physicians whose patients participate in the survey have never protested or objected to the programs, but rather, there have been many expressions of appreciation and approval. Every physician is treated with tact and consideration, his relationship with his patient is carefully protected, and every effort is made to preserve his professional prerogatives.

Employers have not only accepted the survey but express their satisfaction emphatically by a well-nigh universal participation.

Cooperative Medical Services

brief Between 1926 and 1954, the national industrial accident frequency was reduced 75 percent. Since 99 percent of all employers in 1957 had fewer than 500 employees, this rate reduction presumably occurred primarily in small plants.

Based on a paper by W. W. Dickinson, M.D., medical director, Hartford Small Plant Medical Service, Hartford, Conn.

During this period, medical services were being established and preventive medicine was being applied to industry.

As 30 years of such experience records, I find it difficult to understand the apathy of a management which has never endeavored to establish a medical department and has no interest in absenteeism rates, labor turnover, and compensation and accident-sickness costs. In talking with some of these employers, I have found that they did not know that medical service could reduce such losses by 50 to 60 percent.

There are many ways to approach the problem of supplying medical services to employees in a small plant. The main stumbling block to setting up a medical department in these plants seems to be space for a dispensary and the annual salary of a full-time registered nurse at a minimum of \$4,000.

One solution is the employment of a full-time physician on a salary basis by a group of companies in a community. Each firm supplies its own medical quarters and nursing staff. Well-known examples of this arrangement are the East Liverpool (Ohio) District Potteries Industrial Medical Service and the Hartford (Conn.) Small Plant Group Medical Service. Another such group, instituted in December 1955, is the New Haven Small Plant Medical Program.

In Winder, Ga., six firms support the Manufacturers Health Clinic. The clinic was established in a central location for the use of six companies, with a nurse in charge. The nurse visits first-aid facilities at the industrial sites. Doctors in the county are called upon to serve the patients when necessary.

Several New York office buildings have central clinics for tenants who may wish to provide medical service to their employees.

In Asheville, N.C., the Occupational Health Center is operated by a physician and serves several small companies. A mobile trailer is used by this clinic's staff for periodic physical examinations, X-rays, and laboratory tests.

Proprietors of small business establishments who are interested in medical services for their employees may find it useful to refer to the 1959 report on "Company Medical and Health Programs" prepared by the National Industrial

Conference Board, Inc., 460 Park Avenue, New York 22, N.Y. A complete discussion of the various types of programs for medical services, together with details of operation and policy, is found in this document.

Hartford's Plan

In Hartford, our program is a cooperative effort which permits neighboring companies to share expenses. The Hartford Small Plant Medical Service was formed in 1946. Six firms, employing about 3,000 employees, were represented in the original group which met to consider how they could administer jointly a comprehensive medical program which they individually could not afford. Three of the original firms still belong to the service; four other firms have been added.

The idea of a central clinic was discarded as impractical because the cost of staffing and equipment was excessive, it could not give fast and convenient service to all members, and employees would lose too much time from production in travel. The final plan, which was the result of voluntary cooperation by local physicians, the Connecticut Medical Society, the State bureau of industrial hygiene, and the Manufacturers Association of Connecticut, called for individual dispensaries, equipped and staffed by a registered full-time nurse at each plant and a full-time physician rotating among the plants, giving professional supervision to each nurse and the benefit of his professional knowledge to each company group. The physician is called the medical director and reports to the personnel officer of each company. The nurses are responsible to each management as employees with full benefits, although their activities are supervised by the medical director. Coordination is achieved through regular meetings of the nurses with the medical director and the medical director with the personnel officers.

The medical director is retained by each company on an annual contract basis, payment being made at an hourly rate according to the predetermined needs of each plant. The minimum amount of time allotted to each company is 4 hours weekly. It is my belief that 2 hours a week is necessary for the first 100 employees,

adding an hour for each additional 100 employees.

Ideally, factories should not be separated by more than 3 to 5 miles, to avoid travel time loss, unnecessary expense, and delay in response to emergency demands.

Dispensaries vary in size from 600 to 1,200 square feet. The preferred size, as determined by allotting 3 square feet for each employee, provides adequate space for treatment and recovery rooms, laboratory, and consultation.

The medical director performs about 176 physical examinations per plant each year. And during 1958, I held 2,300 consultations with employees. Preventive medicine is emphasized and influenza and Salk vaccine injections are given.

Tensions and financial limitations cause many employees to avoid visits to their family doctor for what they consider minor symptoms. In the interest of early treatment and keeping the working force healthy, which is after all our main objective, we welcome consultations and visits to the dispensary. Although no treatment is given for conditions unrelated to employment, we do examine employees, help temporarily with a minor illness such as a head cold, and, if investigation and further treatment are indicated, we urge the employee to visit his doctor. Attending physicians are welcoming our services more and more, leaving the return-to-work status entirely within our judgment.

Management should evaluate more carefully the nurse's contribution to industry. I call the eight on duty at our dispensaries the "jewels of our service." Their patience, understanding, and professional, administrative, and counseling abilities act as a buffer between labor and management. Litigation is prevented time and time again through a nurse's arbitration, and frustrated, upset, and injured employees find their neuroses nipped in the bud by her practical and interested counsel. Industrial nurses are registered specialists, and a medical service program must rely on their abilities for much of its successful operation.

The national accident level in 1958, according to the U.S. Department of Labor, was 4 percent less than in 1957 and the lowest in 20 years. Connecticut's accident level decreased 14.2 per-

cent. But even with this improvement, 881,000 man-days were lost in Connecticut during 1958, at a cost of almost \$97 million.

Our experience shows that medical service similar to the Hartford plan, at an average cost of \$20 annually per employee, can result in decreases of 50 percent in absenteeism, 60 percent in labor turnover, 75 percent in lost-time accident rates, and 60 to 90 percent in the accident frequency and severity rates.

Visiting Industrial Nurses

brief Part-time hourly industrial nursing service meets a community need in Philadelphia, where experience has shown that sound public health nursing principles can be applied by provision of in-plant services to selected small industries.

The Visiting Nurse Society of Philadelphia first offered hourly nursing service to small plants in 1932, as a demonstration project in cooperation with the Metropolitan Life Insurance Company and the Philadelphia Tuberculosis Association. After 8 years, the insurance company and the association felt that the program had proved itself and withdrew. The Visiting Nurse Society has continued the program, serving from two to eight plants. At present, we are serving four.

A physician certified in industrial medicine is a member of the society's medical advisory committee and each plant served is required to employ a physician to give medical direction and assume responsibility for health services.

Visits to the plant are on a scheduled basis, the doctor at least once a week, and the nurse according to predetermined plant needs. Experience has shown that an appropriate minimum nursing service per day is 2 hours; the maximum continuous nursing service is 4 hours daily. One hour is not sufficient for adequate service and proper identification with plant personnel. And we have found that plants re-

Based on a paper by Bernice Krakow, R.N., occupational health consultant, Visiting Nurse Society of Philadelphia, and instructor in occupational nursing, Woman's Medical College of Pennsylvania, Philadelphia, Pa.

questing more than 4 hours daily nursing service usually need full-time coverage.

A simple contract is executed between plant management and the society, which specifies the amount and kind of nursing service to be given, the hourly cost, and a termination clause. The contract is renewed annually.

The hourly charge for nursing service is based on salaries, vacation, sick leave, transportation, and other overhead costs such as workmen's compensation, social security, pensions, and the like. At present the charge is on a sliding scale: \$4.50 the first hour, \$4.25 the second hour, and \$4 for each subsequent hour. These figures were computed from cost analysis findings.

Selection and Inservice Training

Aside from the improved quality of industrial nursing performance, we have found that any public health nurse oriented in occupational health has a broader basis for understanding the problems of her patients than nurses without such orientation. One of our long-range and admittedly idealistic goals is to expose all of our staff to this program.

Our visiting industrial nurses are selected on the basis of their interest in occupational health, an evaluation of field service performance in public health, and consideration of individual potential. The nurses selected are offered inservice orientation classes in a series varying from 16 to 20 hours. Basic concepts of industrial nursing are discussed, problems are outlined, and functions and responsibilities are defined. An attempt is made to permit class participants an opportunity to observe health services in industry through visits to a plant served by the VNS, to a large plant with full-time nursing service, and to a labor health center.

Nurses are assigned to a plant as one aspect of their general fieldwork. Their first plant assignment is usually as an alternate or relief nurse. As newcomers, they learn much from the periodic group meetings of the occupational health nursing staff at which mutual problems are discussed and program changes and information on current trends are also on the agenda.

To encourage further inservice training, the

society is a member of the National Safety Council, subscribes to appropriate periodicals, and arranges for representative attendance at community meetings, conventions, and lectures. For the past 3 years, the Woman's Medical College of Pennsylvania has offered a certificated course of seven sessions in occupational health nursing, and selected nurses are given the opportunity to attend these sessions.

Within the society, the occupational health consultant is responsible for the promotion, programing, training, and supervision of nurses in industry.

Services

The services the public health nurse offers industry and the degree to which she uses her training depend on the attitude and interest of the medical director of the plant and the support given by management. We have seen progress over the years, however, from a first-aid dispensary for treatment of lacerations to full recognition of all health services.

The responsibilities of the visiting industrial nurse, as we see them, are concerned with first aid, physical examination, followthrough, health education and counseling, and safety.

Although the nurse assumes responsibility for first-aid treatment when an accident or illness occurs while she is on duty at the plant, a major contribution in part-time service is the instruction of the first-aid team, arrangements for care in the nurse's absence, an emergency referral system, and careful followthrough.

The nurse assists in the technical details of a physical examination and takes the patient's health history.

Since the public health nurse brings to industry experience in working with family health problems and a knowledge of community resources, she is in a unique position to encourage and follow up on employee compliance with recommendations of the medical director, the family doctor, and the tenets of good health practice.

Public health education of employees on an individual or general program basis in a plant setting can be a part of the nurse's responsibility, in view of her knowledge and background in field service. Also, the part-time industrial

nurse, as a part of the Visiting Nurse Society, can encourage the participation of small plants in tuberculosis, glaucoma, diabetes, and other surveys; arrange film showings, lectures, and demonstrations, depending on need and reception; and call on the society's resources for consultation with specialists, such as the nutritionist, to help plan for weight-reduction classes for obese employees.

The nurse is a member of the safety committee of the plant and frequently interprets health and safety hazards to management.

Problems

There is difficulty in promoting use of part-time industrial nursing services by small plants in the community. This may be due to lack of understanding, professional restrictions to many promotional techniques, its cost to the plants since benefits of the service are essentially intangible, changing economic patterns, or lack of funds in the society for promotion of this service.

Within the Visiting Nurse Society itself, staff turnover makes it difficult and costly to train nurses for industrial service and to give continuity of service to small plants. Historically, the society sees itself in the role of a source of bedside care to the sick. The orientation and education of supervisory personnel in the importance of the industrial service in relationship to total service merits special and separate planning. Supervisory support is essential to staff morale and quality of care in the plants. Rising costs of all services produce concern for the society's ability to continue to supply industrial service.

Experience has shown that the society's insistence on medical direction has been a factor in management's lack of interest in purchasing the service. Also, many physicians who give part-time service to plants are not interested or trained in occupational health. This results in inadequate program, irregular service, and lack of interest in plant personnel. In the end, man-

agement feels it is not getting enough for its investment.

Gains

We believe, however, that the value of the program outweighs its difficulties. In a small way, we impress the community with the importance of occupational health services to employees of small plants. These people should have the same health advantages as employees of large business establishments. Between 1950 and 1958 inclusive, 14,750 employees of 8 small plants in the Philadelphia area received 75,606 visits from our part-time industrial nurses. These employees represent a group which otherwise would probably not have had the benefit of such services.

Nurse training in the occupational setting adds background and understanding which help the staff in general service. Few diploma or degree programs offer occupational health nursing courses and the average nurse entering industrial nursing learns by experience. We are in a position to offer better service to the industrial community since our public health nurses are specially trained and carefully supervised.

Industrial service encourages interest in occupational health, particularly through the field observation opportunities given to selected university students.

Our records show only three reasons for termination of the Visiting Nurse Society's industrial nursing service after it has been instituted. They are economic reverses at the plant, relocation of the industry to an area outside the society's scope, or employment of a full-time nurse.

We are most gratified when a full-time nurse is employed, because to us it means that we have met our long-range goal. We have demonstrated the program and proved its value. As a result, management has assumed full responsibility, leaving the society free to promote new service in another plant.

Signs

and

Symptoms

of trends in public health

Increases in drownings and water accidents caused the Greater Cleveland Safety Council to start a water safety campaign in 1955. Meetings and consultations with boating enthusiasts and commercial and civic groups resulted in the formulation and adoption of a city ordinance establishing firm rules and providing for the prosecution of reckless boat operators by stiff fines and even jail sentences. A community education program, supported by many of the local and national organizations concerned, publicized the new ordinance.

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Every county in Virginia now has at least one practicing physician as a result of an intensified scholarship and placement program. Fifteen years ago, 6 Virginia counties were without a physician, and in 12 counties there was only one physician for every 15,000 residents.

A State program awards scholarships to medical students who pledge 1 year of practice in a rural area or in a mental or tuberculosis hospital. About 250 physicians have been placed since 1951.

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Water resources in Rensselaer County, N.Y., are revealed in a progress report published recently by the county health department. The housing composition, different types of water usage, known domestic and municipal water supply needs, and the value of an adequate supply of satisfactory water are discussed, and a population study is described.

This is the first of a series of environmental health studies planned by the department.

A new and growing development in prepaid dental care is the establishment of dental service corporations by State dental societies. In January the American Dental Association counted 10 constituent dental societies with such service corporations organized. Four were operating in California, Oregon, Washington, and Rhode Island.

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Pennsylvania has enacted a new law (act 302) governing burial of radioactive wastes which Governor David L. Lawrence calls "a major forward step in protecting the public against possible atomic age hazards." The new law establishes legal requirements for burial of "hot" radioactive wastes, a permit system for applicants, rules and regulations for burial, and penalties for violators.

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Careless eating habits or too much sugar are more likely to be the main causes of ulcers than strain, stress, or excessive responsibility. Dr. Charles Pulvertaft, radiologist to city and county hospitals in York, England, reported after a survey of more than 2,600 ulcer patients in urban and rural York areas, conducted by the York Peptic Ulcer Research Trust.

In general, he said, there were fewer ulcers among top-ranking businessmen than among lower paid people doing routine and often unimportant jobs. Shift workers were cited as being particularly ulcer prone. But worst of all, according to the survey, are people who go without food for more than 5 hours in the afternoon or eat only sandwiches.

Speeding in an ambulance has been condemned by a joint medical-safety committee of the American College of Surgeons, the American Association for the Surgery of Trauma, and the National Safety Council after a survey of 865 cities on emergency care for the injured.

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Doctors in Boulder County, Colo., in the course of a 1959 State health department drive to encourage immunization against poliomyelitis, gave 20,472 injections in two 3-day campaigns within 1 month.

Population of the county is approximately 70,000, and only 3 cases of poliomyelitis were reported in 1957, none in 1958, and none in 1959. One-third of the injections were first shots and about 60 percent of the respondents were adults more than 19 years of age.

The State health department purchased the vaccine, guaranteed an adequate supply, and sold it to physicians at cost.

Injections were made available in all doctors' offices at reduced rates of \$5 for the entire family or \$2 per injection if the family consisted of fewer than three persons. At the same reduced rates, hospital clinics, staffed by volunteers, participated on Saturday night during each campaign.

A review of Boulder County's campaign appears in the March 1960 issue of the *Rocky Mountain Medical Journal*.

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Although most teenagers don't believe they are the Nation's poorest drivers, a comprehensive "accident involvement" survey conducted by the Bureau of Public Roads found that "Drivers under 20 years of age had the highest rates and were involved in accidents at a rate in excess of two and one-half times that of all drivers." A Purdue University opinion panel poll found that fewer than half of 11,000 young people checked knew that they constitute the age group with the worst driving record.

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Mental health practice by public health nurses is discussed in the May 1960 issue of *Nursing Outlook*.

The Peeling House Paint Hazard to Children

EVELYN E. HARTMAN, M.D., WILFORD E. PARK, M.D., and H. GODFREY NELSON, B.S.

THE occurrence of lead poisoning among small children living in poorly maintained homes in some centers of population in parts of the United States has been well established (1-4). Studies on urinary lead levels in the absence of symptoms of lead poisoning have been mentioned less frequently in the literature. This study was undertaken to determine whether or not abnormally high urinary lead levels might be found among Minneapolis children even in the absence of lead poisoning symptoms.

While no deaths from lead poisoning among small children have been reported to the Minneapolis Health Department for several years, and no diagnosed cases have been referred to the health department for followup, it was felt that there was enough uncertainty to warrant a study of urinary lead levels among small children attending well-child clinics.

Screening in Clinics

The children chosen for the study were those attending the well-child clinic at the Minneapolis Public Health Center, which is operated four times per week, with an average caseload of 17 per session. The clinic was chosen chiefly because the participating children come from all parts of the city rather than from any one

The authors are all with the Minneapolis Health Department, where Dr. Hartman is director of the bureau of maternal and child health, Dr. Park, chief of the occupational health service, and Mr. Nelson, public health chemist.

area. This clinic has an additional advantage in that it is in the same building as the city public health laboratory. Financial eligibility standards restrict the families attending to those in the lower middle and low income brackets. Clinic service is available to children from birth until they enter school at 5 years of age.

Spot samples of urine were collected while the children were attending the well-child clinic. Very few urine samples were obtained from children under 2 years of age. If the child was unable to void, no further attempt was made to obtain a sample until the child again visited the clinic in his regular appointment schedule. Eliminated from the study were samples with an insufficient quantity of urine.

The urine samples were obtained through the use of a potty chair with a special laboratory tested leadfree vessel and were transferred immediately to a labeled, leadfree, Pyrex flask, with a large mouth and covered by an overlapping rubber cap. Urine specimens were kept in a refrigerator until picked up by the chemist.

Lead analyses were made in the Minneapolis Public Health Laboratory by Godfrey Nelson, using the modified dithizone method that has been used by the Minnesota Department of Health Laboratories since 1951. Preliminary work was done during the summer of 1958 by this worker in familiarizing himself with the laboratory technique. The urine specimens were also tested for albumen and sugar and for evidence of phenylketonuria. The results of these tests will not be reported in this paper.

The study began on August 25, 1958, and was terminated on October 10, 1959.

Between August 25, 1958, and April 30, 1959, a total of 199 specimens of urine from children attending the well-child clinic were examined (table 1). Only one of these urine samples contained more than 0.08 mg. of lead per liter, which is considered the high point within the normal range. This high urinary lead was found on April 22, 1959 (tables 1 and 2).

Between May 1 and October 10, 1959, when the study was discontinued, 194 more urine samples were examined in the well-child screening program and 6 more were found to have high lead content. The high urinary lead cases found through the well-child clinic are cases 1, 2, 10, 11, 12, 15, and 16 in table 2. In these, the lead levels ranged from 0.10 mg. to 17 mg. per liter.

A home survey was made to determine the source of lead in all seven of the high lead cases found among the well-child clinic children. In each case a search was made for the usual sources of lead within the home, such as evidence of paint chewed off toys and cribs, chip-

Prevention of Lead Paint Poisoning in Baltimore

Activities aimed at protecting teething children from lead paint poisoning in Baltimore, started in 1931 by the city's health department, were expanded in December 1959. At that time, inspection teams of workers from the city health department and housing agency visited the homes of children of about a year old who attend the well-baby clinic of the Druid Health District, an area with a history of many lead poisoning cases among children. Parents are informed of the lead paint danger and samples are taken for analysis. Any paint containing lead is ordered removed.

Following initial coverage of about 250 homes, the schedule calls for testing 15 homes a week on a continuing basis.

In the first home visited after the project's inauguration, 16 out of 26 paint samples tested positive for lead. The visit also pointed up mass health education needs: an apartment in the building was being painted gaily for Christmas from cans clearly labeled as containing lead and not for use in interiors. Health authorities recognize the need for community cooperation from paint manufacturers, who must supply a wide selection of leadfree paints to mothers who will need to exert fullest vigilance over their small children's activities.—*From Baltimore Health News, February 1960.*

Table 1. Findings of lead analysis of urine specimens from the well-child clinic of the Minneapolis Public Health Center during the period August 25, 1958–October 10, 1959, by month

Month	0.08 mg. per liter or less	More than 0.08 mg. per liter	Total tested
<i>1958</i>			
August.....	9	0	9
September.....	21	0	21
October.....	14	0	14
November.....	8	0	8
December.....	25	0	25
<i>1959</i>			
January.....	34	0	34
February.....	28	0	28
March.....	33	0	33
April.....	26	1	27
May.....	33	1	34
June.....	40	0	40
July.....	38	3	41
August.....	48	0	48
September.....	23	2	25
October.....	6	0	6
Total.....	386	7	393

ping wall and floor paint, lead water pipes, and burning of storage battery cases. In several instances samples of tapwater were analyzed and found to be free of lead. While inside maintenance and housekeeping frequently left much to be desired, no obvious sources of lead within the homes were found except in cases 15 and 16. Inquiry was made as to pica, and was admitted in cases 11, 12, 15, and 16. The children in cases 11, 15, and 16 ate dirt while playing outdoors. The child in case 12 had been eating plaster, but an analysis of the plaster revealed no lead.

Followup on cases 15 and 16 showed the lead source to be lead dust brought home on the clothing of two men living in the multiple dwelling which housed the families of both children. Both men worked in the same stor-

Table 2. Findings of initial and final analyses of urine in cases with high urinary lead, Minneapolis

Case No. and patient	Urinary lead levels				Final examination ¹			
	Date	Mg./liter	Date	Mg./liter	Date	Urine lead mg./liter	Hb. gm./100 cc.	Symptoms and medical findings
1. MS-----	4/22/59	0. 17	5/4/59	0. 18	10/28/59	0. 04	12. 0	None.
2. BD-----	5/13/59	. 14	6/22/59	. 14	7/8/59	. 14	-----	None.
3. RT-----	7/1/59	. 21	8/10/59	. 12				
4. GT-----	7/1/59	. 13	8/10/59	. 09				
5. MT-----	7/1/59	. 18	8/10/59	. 07				
6. GG-----	7/6/59	. 09	8/10/59	. 16	10/16/59	-----	12. 0	None.
7. LR-----	7/6/59	. 12						
8. RSp-----	7/13/59	. 11	8/10/59	. 20	10/22/59	. 06	12. 0	None.
9. RSw-----	7/13/59	. 16	8/10/59	. 08	10/22/59	. 04	11. 5	Poor appetite, vomiting, pica, earache, red drum.
10. DJ-----	7/14/59	. 14	8/10/59	. 08	10/22/59	. 04	13. 5	None.
11. KL-----	7/15/59	. 10	9/4/59	. 10	10/22/59	. 11	12. 0	Pica.
12. CR-----	7/22/59	. 16	8/11/59	. 17	10/1/59	. 06	9. 0	Pica, dietary deficiencies (hospitalized).
13. JM-----	8/10/59	. 30	8/12/59	. 28	10/29/59	. 03	12. 5	None.
14. MA-----	8/28/59	. 13			10/22/59	. 09	13. 0	None.
15. VS-----	9/11/59	. 12	9/21/59	. 07	10/22/59	. 07	12. 0	Pica.
16. HH-----	9/21/59	. 12			10/22/59	. 05	11. 0	Pica.

¹ In the final examination, none of the specimens showed stipple cells.

age battery manufacturing plant. One of the children played with the workshoes of one of the men. Paint cans were also found stored in the bathroom shared by both families. Analysis, however, showed the paint to be low in lead (0.6 percent). No loose paint was found on the multiple-dwelling house.

In the other five cases with high lead levels, no source of lead was found inside the homes. In each case, however, paint was peeling off the exterior of the houses. Upon questioning, it was found that the children usually played in areas immediately adjacent to the houses. There was no vegetation in these play areas, and particles of dried paint were mixed with the dirt. Analysis of this dried paint showed a lead content ranging from 12 to 42 percent, with an average of 24 percent.

Urine was not obtained from the preschool sibling of case 1. In the other cases, there were no siblings in the age range of 2 to 5 years.

Children in Selected Homes

Since the first two cases found in the clinic screening were believed to be related to chipping outside house paint and since the housing section of the Minneapolis Health Department was also interested in the health significance

of chipping paint from the standpoint of housing maintenance, the study was expanded to include samples of urine obtained from small children who were known to be living in houses with exterior paint obviously peeling.

About July 1, 1959, a search began for such houses. Some were brought to our attention by the housing section. Others were spotted by Dr. Park while driving around the city on other health department business. When a house with badly peeling paint was surrounded by well-trodden ground close by, the occupants were asked whether or not the residents included children between the ages of 1½ and 5 years. If there were children of these ages, the visitor identified himself and the purpose of the study was explained. The mother was told that the health department wanted to determine whether or not the falling paint was creating a health hazard. Spot urine samples in leadfree flasks were obtained from the small children, and a sample of the falling paint was collected for lead analysis. At the same visit, the parent was urged to keep the children from putting the chipped paint in their mouths.

In the study of 14 homes with badly chipped or peeling paint on the exterior where there was evidence that the children played close to the house, analysis of the various paints showed

a high lead content, usually between 15 and 30 percent. Urine was obtained and analyzed from 24 of the young children living in these homes. Of the 24 children, 9 were found to have abnormally high lead levels in their urine samples (table 3). In only one house was more than one child found with high urinary lead content. In this home, three children aged 2, 3, and 4 years had lead in the urine measuring 0.18, 0.13, and 0.21 mg. per liter, respectively. These cases are 5, 4, and 3 in table 2. In none of the houses where a child was found to have high urinary lead were sources of lead observed other than the peeling exterior house paint. In this part of the study, only case 9 had a history of pica, according to the parents.

Findings From Poorly Maintained Homes

By combining the 5 cases of high urinary lead related to peeling exterior house paint, found through the well-child clinics, with those found in selected homes, a total of 14 children with high urinary lead levels was obtained. These were found among small children living in 19 homes with badly peeling paint wherein no other source of lead was found. The urinary lead levels in these 14 cases ranged from 0.09 to 0.30 mg. per liter (table 2, patients 1 through 14).

Twelve of the fourteen children provided urine specimens again about a month later. At this time the lead levels in the urine of five of the children were essentially the same as before, two had significantly higher urinary lead than

previously, two had lower, and in three children, the urinary lead had fallen to normal level.

Three of the children (cases 3, 4, and 5) whose second urinary lead tests were either normal or distinctly lower than formerly, lived in the one house which was painted during the study. The painting was done at about the time the first urine specimens were obtained and further falling of paint thereby prevented.

Followup

During the month of October 1959, an attempt was made to give a final check to each of the 16 children who had high urinary lead levels. One child, case 12, with a hemoglobin of 9 grams had previously been referred to the Minneapolis General Hospital for more extensive studies because of marked pica and dietary deficiencies. The high urinary lead was verified by the hospital, and, although there were no physical findings nor symptoms warranting a diagnosis of lead poisoning, a 5-day course of ethylenediamine tetraacetic acid was considered justified. On the fourth day of the EDTA treatment, the urinary lead was 0.54 mg. per liter, and the blood level 0.04 mg. percent. At completion of the treatment, the urinary lead was found to be a normal 0.06 mg. per liter.

The remaining 15 children were asked to report to the well-child clinic for a physical examination by Dr. Hartman. Ten of the fifteen did report and, at that time, urine specimens were obtained from nine of them for lead analysis. Blood was obtained from all 10 for hemoglobin estimations and stipple cell counts. In seven of the nine urine specimens examined at this time, the lead levels were normal, and in the other two, readings of 0.09 and 0.11 mg. of lead per liter were obtained (table 2). None of the children had any stippling of red blood cells. The hemoglobin levels ranged from 11.0 to 13.5 grams per 100 cc. None of the children had exhibited any signs or symptoms pointing toward a diagnosis of lead poisoning, and this includes cases 3, 4, 5, and 7, who were seen by Dr. Park at the time the first urine specimens were collected. Cases 9, 11, 12, 15, and 16 had a history of pica. Parents were again warned about the hazards of children putting dirt in their mouths.

Table 3. Findings of lead analysis of urine specimens from children living in selected houses with peeling paint in Minneapolis, by month, 1959

Month (1959)	Number of houses	Urine specimens		
		Number with lead 0.08 mg./ liter or less	Number with lead more than 0.08 mg./ liter	Total num- ber tested
July.....	11	12	7	19
August.....	2	1	2	3
September....	1	2	0	2
Total....	14	15	9	24

Discussion

We recognize that the use of spot samples of urine for lead analysis has limitations and may be open to question. Sometimes a case of lead absorption may be missed when only one sample is obtained. On the other hand, high urinary lead, when found in a spot sample, is an indication of excessive lead absorption. In this study, blood test lead was not determined because the children had no symptoms of lead poisoning, and there seemed to be no necessity to attempt to establish a diagnosis of lead poisoning.

The occupational health service of the Minneapolis Department of Public Health, under the direction of Dr. Park, has for several years been collecting and analyzing spot samples of urine to measure industrial exposures to lead. In this work it was found that spot urine samples are a reliable indication of the degree of lead absorption, if the following conditions are met: the urine samples are collected on separate days, the specimens are not contaminated with extraneous lead, and two or more specimens are in close agreement on lead content (5).

A similar experience, with spot urine testing for lead, was reported through personal communication by W. G. Frederick, of the bureau of industrial hygiene of the city of Detroit, in October 1956.

The possibility of contamination during collection of spot samples of urine, by the methods used in this study, may raise some doubt as to the validity of the results. We have found instances of contamination in industrial surveys, but the lead content in the urine in these cases has always been so excessive that contamination was immediately detected (5).

There is reason to believe that lead hazards inside of homes in our city are minimal, since a fair sampling of urine specimens (386) from children attending the well-child clinic were found to be normal in lead content. The children came from homes from all parts of the city from the lower middle and low socioeconomic groups. In the seven cases with elevated urinary lead levels among well-child clinic patients the lead source was traced to factors other than those within the homes.

Except for cases 15 and 16 the cases found through the well-child clinic were caused by

chipping exterior house paint. Although the parents gave a history of pica in only two of these five children, it has been noted that mouth-ing of materials is an almost universal habit of young children, exclusive of pica (3,6). We therefore believe that the elevated urinary lead was caused by ingestion of the peeling house paint which was mixed in the dirt in which the children played.

All of the five cases were found in the spring and summer months of 1959 from among 199 specimens collected during the last week of August 1958 and April through August 1959 as compared with 2 abnormal lead levels among 194 urine specimens collected at other times of the year. These two cases were not caused by chipping outside house paint. This seems to support the suggestion of Baetjer (4) that children may have more opportunity to ingest exterior paints in the summer. Our study of elevated urinary lead even in the absence of symptoms of lead poisoning seems to parallel the seasonal incidence of lead poisoning found in Baltimore (4) and Boston (3).

If we take only those small children who are known to be exposed, that is, if we start with those in the selected homes as we did in the second part of this study, we get a very high proportion with high urinary lead (table 3). Of 24 children exposed to these conditions in 14 such houses, high urinary lead was found in 9. If we include the five children with high urinary lead levels who were found through the well-child clinics and who lived in the 5 separate houses in similar condition (cases 1, 2, 10, 11, and 12 in table 2), we get a total of 19 homes with peeling outside paint. In these 19 homes, urine specimens were obtained from 29 small children, of which 14 had high urinary lead content. This amounts to 48.3 percent of the urines examined and is comparable to the 44.4 percent found in Baltimore some years ago, when a more extensive study was made using specimens of blood instead of urine for the lead analyses (2,7).

In terms of the buildings themselves in relation to the number of small children with high urinary leads, we find that 19 peeling houses gave us 14 children with high urinary lead. This in terms of probability means that for every 100 such houses, with small children

living in them, there are likely to be 74 children eating enough of the falling lead paint to raise their urinary lead level above normal during the summer months. While not many will eat enough paint; over a long enough period, to cause manifest lead poisoning, this is a lead hazard which housing authorities and the Minneapolis Health Department cannot afford to ignore.

Conclusion

While this study does not cover sufficient numbers to warrant any definite conclusions, the following comments seem to be pertinent:

- The study did not reveal lead hazards to small children in Minneapolis which could be traced to conditions inside of the homes, although the possibility that such hazards exist cannot be completely excluded.

- The finding of some cases of high urinary lead levels among small children in the absence of symptoms of lead poisoning seems to parallel the seasonal incidence of lead poisoning found in children in other cities.

- The paucity of actual lead poisoning among small children living in poorly maintained houses in Minneapolis may be related to a shorter summer season (shorter exposure period) rather than to any difference in the hazard associated with falling exterior lead paint.

- Health departments and housing authorities, in concern for the health of small children living in houses where the exterior paint is chipping off, should consider developing control procedures (8).

- Parents and the public should be warned of the health hazard of small children ingesting the paint which has chipped off walls of houses and outbuildings.

Summary

Between August 25, 1958, and October 10, 1959, a total of 417 specimens of urine from children (5 years and under, without symptoms of lead poisoning) were analyzed for lead at the Minneapolis Health Department laboratory. Of these specimens, 393 were obtained through a screening program carried out in

well-child clinics, turning up 7 with high urinary lead. The remaining 24 specimens were obtained from children living in houses selected for study because of their obviously peeling paint. Among the latter specimens, nine were found to be high in lead content. While screening through the well-child clinics lasted nearly 14 months, the study among children living in the preselected homes was carried out only during July, August, and September of 1959.

All of the specimens with high urinary lead were associated with peeling exterior house paint, except for two cases found through the well-child clinics. In these two instances the source of lead was traced to lead dust brought home on the clothing of two adults who worked in a storage-battery manufacturing plant. When the figures of the two studies are combined, 14 out of 29 children living in 19 houses with peeling paint had high urinary lead levels. All of these 14 children are believed to have ingested the lead although only 3 had a definite history of pica. The children played in the dirt adjacent to the houses where peeling paint had fallen into the play areas.

None of the children with high urinary lead manifested sufficient signs or symptoms to warrant a diagnosis of lead poisoning and by late October, almost all urinary levels had returned to normal.

All of the high urinary lead levels appeared during the summer, suggesting a seasonal outdoor exposure and the absence of significant all-year inside exposures.

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The Anatomy of an Accident

ALBERT L. CHAPMAN, M.D.

ACCIDENT is a word applied to the culmination of a series of events which result in harm to the individual or damage to property.

Accidents originate in unsafe acts. The end result of a small proportion of unsafe acts is an accident.

A small proportion of accidents result in accidental injuries. Accidental deaths are the end results of a very much smaller proportion of accidents.

In essence no accidental death, no accidental injury, in fact no accident, can occur unless it is preceded by an unsafe act.

Therefore, the most important element that accident prevention programs must seek to eradicate are unsafe acts themselves.

An example may serve a useful purpose. A man walking along a city street was hit on the head by a flowerpot. His skull was fractured. Two days later he died. Here was an accident, an accidental injury, and an accidental death. But where was the unsafe act?

Is it to be presumed that to be safe one must never walk on the sidewalks of a busy city street?

No! The victim of this accident engaged in no unsafe act, but—there was one—in fact there were at least two unsafe acts.

The mother who, to liven up her drab apartment, placed a potted plant on the window sill committed the first unsafe act. She had never been conditioned to think in terms of accident prevention. She gave no thought to the even-

tual consequences of what she did. The child who leaned out of the window to peer at the crowd below and in so doing brushed the potted plant off the window sill committed the second unsafe act.

Other unsafe acts were involved, of course. The building should not have been built with sills directly over the sidewalks and there should have been regulations prohibiting such dangerous practices as putting a potted plant on a window sill.

If the first or third unsafe act had not occurred, the second unsafe act would not have been possible.

This illustration serves to demonstrate that individuals cannot by living safely, and behaving safely, always insure themselves against accidental injury or death due to the ignorance or carelessness of others.

Accident prevention indoctrination must be directed not only toward self-preservation but also toward the protection of others.

In considering ways and means of preventing accidental deaths and injuries then the aim must be to prevent, or at least to greatly decrease, the incidence of unsafe acts. This is true since no one can predict precisely which unsafe act will result in an accidental death or in an accidental injury.

This same illustration demonstrates this point. If no one had been in the path of the falling flowerpot, the two unsafe acts which were committed would have caused an accident (the breaking of the flowerpot), but there would have been no accidental injury or death.

An accident has several sides. One side is the environmental side—the flowerpot on the window sill over the sidewalk. Another side is the

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human, or biological side—the act of placing the flowerpot on the window sill could have been avoided, and even after the flowerpot was placed on the window sill it was only knocked off by the act of an individual.

All of us live in an environment which is potentially dangerous, even lethal, depending upon circumstances, some of which are subject to our own control—some of which are subject to the control of others.

There is no such thing as a “safe” environment. There can only be “safer” environments. Human behavior, conditioned by physical, physiological, and emotional factors of great degrees of complexity, determine the occurrence or nonoccurrence of accidents far more often than environmental factors *per se*.

There is no such thing as a “safe” person. However, persons who have been motivated, trained, and conditioned to behave safely are much “safer” individuals than persons not so motivated, trained, and conditioned.

No matter how thoroughly an environment has been screened for accident-causing potentials, an unsafe person may have an accident or may cause an accident to happen if the circumstances are right.

In addition then to emphasizing the need to help people to adapt themselves to living safely in whatever environment they find themselves, there is a co-equal need to change the environment in such a way that it is less likely to invite accidents.

The paucity of human and financial resources available for expenditures in educating, training, and conditioning individuals to adjust safely to their habitat makes it imperative to conduct studies, call them epidemiological if you will, that will identify those human characteristics which are most productive of accidents. If this is not done, our relatively meager resources will be expended on activities that have the potential for saving only a few lives while activities which have the potential for saving many lives are left undone.

Examples of the types of studies which can give direction to community safety activities are:

- Determining through surveys in homes the actual places where medicines and household poisons are stored.

- Investigating the causes of home fires: for example, faulty electrical wiring, mishandling of kerosene, and improper storage of flammable materials.

- Studying the circumstances surrounding drownings in a community. These can shed considerable light on causative factors, many of which are subject to correction: age, sex, and swimming ability of the person drowned; enclosure of fishponds and swimming pools; and artificial respiration attempted, if any.

This obvious plea to apply scientific counting methods in order to identify the major factors which cause accidents in each locality must, of course, be modified by the need to take advantage of the peculiar interest of each individual and of each community group.

Logic is quite alien to many community activities. Logic alone should not deter anyone from doing the best that can be done under existing circumstances.

Another major factor to be considered in mounting an attack on accidents is the existence or absence of specific measures which will prevent a certain type of accident.

For example, there may be widespread community interest in the development of a poison control program, yet there may be little interest in making radical changes in driver-licensing laws.

A local poison control program may have the potential of saving only 5 lives a year, whereas making the requirements for driver licensing much more drastic may have the potential for saving 50 lives a year in the same community.

The first program is much easier for the lay person to understand; it involves no great sacrifice of personal liberty, and it can actually be developed as a part of existing institutions and organizations.

The latter program is much more remotely associated with accident prevention; its beneficial effects are more difficult to appreciate, it involves more deprivation of personal liberty (a license), and hence must await the preparation of the community mind for its fulfillment. This may take many years.

In summary, then, the fundamental nature of accidents and the inevitable association of unsafe acts, accidental injuries, and accidental deaths must be imparted not only to community

leaders but to the public—to the man on the street.

The fact that there can be no monopoly in accident prevention by individuals or groups is a basic tenet. Every person, every organization, and every agency has a personal as well as an organizational contribution to make to the safety movement.

Leadership, of course, can best stem from specific organizations whose sole function is to prevent or bring about the prevention of accidents. I am speaking specifically of the National Safety Council and State and local safety

councils associated with the National Safety Council.

Finally, a simple truth must be implanted firmly in every mind; namely, that accidents don't happen, they are caused—they are caused by what people do or by what they fail to do.

Acceptance of this truth means that one must admit that since human action can be modified, accidents with rare exceptions are preventable occurrences, and that the same resources mobilized to combat heart disease, cancer, and mental illness should be committed in much larger amounts to the prevention of accidents.

Radiological Health Curriculums in Schools of Public Health

Within the past few years radiological courses have been introduced into most schools of public health, and curriculums specializing in radiological health are currently being offered at several schools. In addition, certain schools have developed a general radiological course which may be included in the curriculum for those students having only an ancillary interest in radiological health. Radiological health training in schools of public health concerns health agencies because radiation safety programs employ many radiation specialists with basic training in biology, chemistry, physics, and engineering. To provide leadership and direction in this field requires personnel versed in radiation and public health.

Schools offering specialized training include Harvard, Johns Hopkins, Pittsburgh, and Michigan. The curriculums initially developed at these schools varied significantly, both in number and types of courses required for an advanced degree. The current trend, however, appears to be toward development of curriculums incorporating basic public health courses plus radiological courses. The public health courses may include epidemiology, biostatistics, and public health administration, whereas the radiological courses include radiobiology, radiation physics, radiation protection and control, and other topics. Flex-

ible rather than rigid or standard programs also appear to be the general trend.

During this transitional and developmental stage of these radiological health curriculums, the schools are interested in exchanging opinions concerning both the quantitative and qualitative aspects of these curriculums. For example, they ask what is the probable demand for radiological health specialists, and are there sufficient university resources to meet these needs? What should be the basic or minimum curriculum for schools specializing in radiological health? To what extent should all school of public health graduates be trained in radiological health? Is further curriculum specialization indicated, directed toward dosimetry, radiocology, biophysics, or political science?

An important aspect in resolving the latter question is the scope of other radiological health training programs being offered in other areas, for example, in schools of medicine and engineering, or in health physics or radiation biophysics programs. Essentially, the status of curriculum development in each of these areas is comparable to that in schools of public health. Thus, it is likely that they would also like to exchange viewpoints and information.

In an effort to provide this opportunity for university personnel, the Division of Radiological Health of the Public Health Service is planning to sponsor a 3-day symposium this summer on the topic "University Curricula in Radiological Health." The symposium will be held August 2-4, 1960, in Princeton, N.J. University staff members, principally from schools of public health, medicine, and engineering, will be invited to participate in the discussions. Altogether, the purposes of this symposium will be to discuss: (a) requirements for radiological health personnel, (b) trends and experience in development of basic radiological health curriculums for various professional disciplines, and (c) staffing, cost, and other problems associated with university radiological health programs.

It is hoped that the symposium being planned, whereby representatives of universities, professional societies, and health agencies may jointly contribute, will assure an orderly progress in the field of radiological health training and thereby further the application of nuclear technology with full regard to the safety of present and future generations.—DONALD A. PECSOK, *acting chief, Training Branch, Division of Radiological Health, Public Health Service.*

Cause and Prevention of Accidents

C. L. WILBAR, Jr., M.D.

THE Pennsylvania Department of Health has two sections dealing with accidents. The section on traffic epidemiology deals with traffic accidents entirely, and the section on environmental safety is concerned with non-motor vehicle accidents.

In Pennsylvania, accidents have been the fourth leading cause of death since 1900 and remain firmly established in this position. In the early part of the century, they were preceded by infectious diseases. Now they are preceded by heart disease, cancer, and vascular lesions of the central nervous system.

But accidents lead the death picture during the first half of the lifespan. They constitute the leading cause from the 1st to the 35th birthday.

In 1958, 5,056 Pennsylvanians were accidentally killed. The death rate from accidents per 100,000 population in that year was 16.2 for motor vehicle accidents and 29.3 for nontraffic accidents.

The U.S. National Health Survey estimates that 3 people in each 10 suffer major accidental injuries each year. A major injury is defined as one which removes the individual 1 day or more from normal activity or causes him to seek medical treatment. In our State, with an estimated population in 1958 of 11,100,000, we would arrive at approximately 3,330,000 major injuries in Pennsylvania during the year, using this formula.

Accidents are prevented by first locating the causes. After having ascertained the causes,

steps are then taken to either correct or modify the environmental hazard or to change the attitudes and habits of the people involved, or both. The Pennsylvania Department of Health through its section of environmental safety is engaged in a survey of the types of accidents that bring people to hospitals.

Information on nonfatal injuries is gathered from 100 hospitals reporting accidental injuries treated to the health department. They show a difference compared to data on types of fatal accidents experienced. There is a higher rate of injuries from nonfatal falls in the middle years of life, but a higher rate of fatal falls in the early and late years. Cuts and piercing injuries seldom prove fatal, yet there are indications that these may be the major forms of non-fatal accidental injuries.

Most nontraffic accidents occur in the home, where the population spends more time than elsewhere. Probably accident prevention measures are less adequately applied in the home than in the working environment. That home accidents can be largely prevented has been shown by concentrated accident prevention programs in selected communities.

As to the personal factors in accident rates, there is a considerable variation in accordance with age. Most fatal injuries occur to persons in the very young and very old age groups, whereas most nonfatal accidents occur in the age group 15 through 24 years. Males have a much higher accident rate than females. Non-whites have a much higher rate than whites. Physical shortcomings which interfere with coordination, balance, and locomotion obviously predispose individuals having these shortcomings to accidents. So do certain visual and auditory abnormalities and conditions, which prevent the individual from having mental

Dr. Wilbar is secretary of health, Pennsylvania Department of Health. This paper is a condensation of an address which he delivered to the junior-senior class of the Hahnemann Medical School in January 1960.

control of his activities such as fainting, convulsions, heart attacks, cerebral hemorrhage, and such.

The mental and emotional makeup of the individual is undoubtedly a major factor as to his accident proneness. There is considerable controversy about the point at which a person becomes accident prone. However, it is clear that certain psychological factors in individuals cause them to be unusually likely to have accidents. An individual who is likely to worry or grieve predisposes himself to inattentiveness. An individual who is quick to anger is likely to lose the cautiousness which helps prevent accidents. Fatigue causes slowing of the reaction time, so that the chronically fatigued individual is more subject to accidents than others. The quality of judgment is difficult to measure, but certainly some individuals do better at judging their own skills and capabilities than others. Then there are, of course, those who have psychoses, psychoneuroses, or neuroses, some of which make them exceedingly accident prone. Accident proneness may not be constant; it may occur only for limited periods when physical or emotional conditions are acute.

Accidents can be prevented by the correction or modification of either environment or attitude. Carelessness, procrastination, disorderliness, confusion, and risks can be recognized and controlled. Correction of physical handicaps and reduction of emotional stress or tension are also possible. In our approach, we try to break the chain of events which leads to accidents. We tailor our educational messages for specific types of accidents and aim them particularly at the high-incidence groups. For example, to reduce gunshot wound accidents, we advise the public to store guns unloaded, to remove bolts before storing rifles, to keep firearms out of children's reach, to store guns in a dry dust-free place, to check the breech before cleaning, to keep loaded firearms out of the house, and to store ammunition separately from the gun or guns.

Under the State health department's plan for prevention and control of the nontraffic type of accidents, a central office advisory committee, composed of a representative of each of the professions and occupations in the department

concerned with accidents, helps to determine and guide the total control program. We have a regional accident prevention program representative on a full-time basis in each of our seven regional offices.

The reporting of accidents by the hospitals is cited above. Mortality reporting comes not only from the hospital but also from death certificates, all of which are filed and analyzed by the Pennsylvania Health Department. Compilation of data on morbidity, mortality, cause and cure, and studying followup of these data collectively and sometimes individually, supports an epidemiological study of accidents.

At the regional level, we need a regional staff steering committee, a home safety inventory, and especially do we need the formation of local safety councils, consisting of interested and able individuals and groups of individuals who will help collect data and bring about the educational know-how for the prevention of accidents in their communities. These councils provide a bridge or vehicle between the technical groups and the general public, and they should be comprehensive in their scope. They can have such subcommittees as home, farm, occupational, recreational, school, and traffic.

Motor vehicle accidents are given secondary attention here because a number of other agencies have been and are continuing to give much time and effort to traffic accident correction. These agencies, however, concern themselves mainly with the safety of the vehicle, the street and highway, and with mass education.

There has been too little concern, in my opinion, with the type of human beings who cause traffic accidents. Only recently have motor vehicle administrators turned to health departments for aid in this area. Since 1958, the section of traffic epidemiology has been headed by a full-time physician, but we are one of only a few State health departments which have such a unit. The job of the health department in this area is: (a) assisting in the establishment of physical standards by acting as liaison agency between the motor vehicle administrators and medical personnel within the State; (b) conducting statistical research, using records now reposing in State motor vehicle agency offices; (c) conducting applied

research to help delineate the human factors which cause accidents; (d) encouraging and stimulating universities and other groups and institutions to engage in research; and (e) assisting in obtaining medical and related consultation for State motor vehicle administrators to help solve individual problems posed by drivers having an alleged physical, mental, or emotional defect.

Consultation toward solving problems of individual drivers who have frequent accidents and are alleged to have some defect has been in effect for a number of years in Pennsylvania. However, in the past we have mainly attempted to establish physical standards for drivers and the periodicity to which drivers should be subject to testing for these physical standards. The Pennsylvania Medical Society has a number of special committees working on standards, and a report was submitted to the Governor's Traffic Safety Council and to the secretary of health. These standards have recently been officially adopted by the Governor and will be enforced by the department of revenue.

Some of our drivers had never received any medical examination and most others had received only one eye examination. We found drivers picked up after accidents who were on the blind pension roll of the State or who had severe heart trouble, severe epilepsy, or other physical conditions which made them completely unfit for driving and most hazardous to themselves and to others. Periodic physical examinations, now required in the State by executive order, are not completely comprehensive but deal mainly with those parts of the body and those conditions which are particularly significant as far as driving a motor vehicle is concerned. It is hoped these examinations will reduce the deaths and injuries from motor vehicle accidents in our Commonwealth.

We are also finding that alcoholism and drug addiction seem to play a major role in motor vehicle accidents. Further study is needed in this area, but obviously such studies will yield significant data.

The skill and industry of private physicians have made possible the control of many of the once prevalent communicable diseases. The

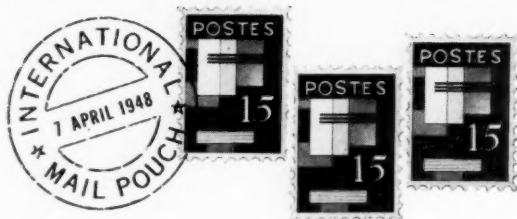
same skill and industry, redirected toward reduction of accident rates, can be depended on confidently to achieve a great deal. Health departments, safety councils, police departments, motor vehicle administrators, and others do at best a shotgun type of education for all of the public. It is the private physician who can determine the accident-prone individual and take the necessary steps to educate him or his family to the extent of appreciably reducing his chances of being harmed.

The personal physician who is best acquainted with the physical, mental, and emotional needs of his patient can best advise against accidents in accordance with individual limits. Who better than the family physician can advise a husband or his wife that it is no longer safe for an oldster, living with them, to go up and down stairs? Who better than the family physician would be in a position to observe the repetition of accidents in a household and the need for referral to the health department for a discreet investigation of the circumstances existing in that household? The physician who has the prevention of home accidents uppermost in his mind will evaluate the patient's accident proneness even as he examines him for signs of disease.

In our State, poison information centers are now available in hospitals within reach of all of our physicians. Poison treatment centers are available in a number of our hospitals. A number of our county medical societies have accident prevention committees.

I believe that hospitals can provide accident prevention information to their patients and their staffs. I would like to see the day when at least one hospital in each major community has a poison treatment center as well as a poison information center. Hospitals can be helpful by recording accidental injuries, analyzing these data for study, and using them for accident prevention within their institutions and their communities.

On the premise that most accidents are preventable, all persons in the health professions can work together and enlist public support with assurance that the toll can be reduced.



Kalinga Prize

Jean Rostand, French geneticist, won the \$2,800 Kalinga Prize for his 105-page book, "Can Man be Modified?" The prize is awarded by the Kalinga Foundation of India under the auspices of the United Nations Educational, Scientific, and Cultural Organization in recognition of an outstanding contribution to the interpretation of science for the general public. The author of some 50 other books, Rostand is known for his experiments in artificially induced parthenogenesis in animals and in directed mutation of toads and frogs by chilling their eggs to alter the chromosome structure.

Working Conditions

Workers in the antimalarial campaign in Surinam face hazardous working conditions in some areas. Casualties have included a drowning in river rapids, a death from an accidental gunshot while hunting for food, vampire bat bites which required treatment for rabies, and bites of poisonous snakes.

—ROBERT BREWER, *sanitary engineer, formerly with the U.S. Operations Mission, Surinam.*

Free of Yaws

Laos is now considered virtually free of yaws after 4 years of effort by two physicians and three teams of technicians. In the southern Provinces, they examined 463,165 persons and treated 16,990 with penicillin, an incidence of less than 4 percent. The technicians found few cases at altitudes of more than 800 meters. One team of workers will continue surveillance.

The World Health Organization delegated a physician to direct the yaws project, the Government of Laos paid the Lao personnel, and the U.S. Operations Mission provided supplies and supplementary stipends for the Lao employees.

—MANLY B. DONALDSON, M.D., *chief, public health division, U.S. Operations Mission, Laos.*

Water for Libya

Developing domestic water systems in Libya requires ingenuity and a range of techniques because of the scarcity of resources common to arid regions and the extensive saline ground water aquifers underlying many towns. Individual dug wells, standard municipal well sources and distribution systems, and modern electrolysis demineralization plants are among the engineer's choices.

For example, to establish a municipal water supply to serve 10,000 persons in Misurata, 1 year of exploratory drilling and ground water studies was necessary to locate an adequate source of acceptable quality. The system, completed in July 1959, consists of three dug wells, a storage reservoir, 8 miles of supply mains, and an extensive municipal distribution system.

In planning a municipal system for Sierte, where the ground water underlying the area is saline, two sources and methods of development are being considered. One would use long galleries to skim the shallow layer of fresh water atop the salt water in sand dunes along the sea; the other would require drilling deep wells in areas remote from the ocean.

For the new hospital in Tobruk, a dual plumbing system carries both potable and saline water. An electrolysis demineralization plant produces 5,000 gallons of treated water per day. The potable water serves medical, drinking, and cooking purposes and the hot water system where it is necessary to conserve heating units and pipes. The saline water is used for general sanitation.

—PAUL AGNANO, *chief sanitary engineer, health and sanitation division, U.S. Operations Mission, Libya.*

Maps and Malaria Eradication

Malaria eradication activities in Nepal are hampered by a scarcity of adequate maps. We obtained a few sheets from the Army Map Service and private sources, which were prepared in 1929 by the Surveyor General of India. They are already out of date and the scale, 1 inch to 4 miles, is much too small. Many villages are not on the maps and some that are marked are not named. As a stopgap solution, we've enlarged them with a pantograph and corrected them as fieldwork progresses.

—RAYMOND E. STANNARD, M.D., *chief, public health division, U.S. Operations Mission, Nepal.*

California's Microfilm Program for Vital Statistics Records

PAUL W. SHIPLEY, B.S., and JAMES S. FULLER, B.A.

THE BUREAU of records and statistics of the California State Department of Public Health as a part of its functions directs the statewide registration of births, deaths, and marriages and provides service to the department and to the public with respect to these records.

The statewide registration of vital events began July 1, 1905, and in the 54 years since, more than 14½ million records have been registered with the department. Approximately 600,000 additional records will be registered during 1960. Two serious problems developed: we were being crowded out of our office by the sheer volume of records, and the older records which received greater use began to wear out.

An examination of these two problems, begun in 1947, developed into a survey by the department and the management analysis section of the State department of finance (1,2).

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Mr. Shipley presented "California's Microfilm Program" before the methodology working group at the seventh national meeting of the Public Health Conference on Records and Statistics held in Washington, D.C., March 24-28, 1958. The methodology working group voted unanimously to publish his report. The paper is, in substance, based on Methodology Bulletin No. 8 of the Public Health Conference on Records and Statistics.

Assistance was also requested and received from many different sources.

Several possible solutions were explored. The traditional solution to crowding is to provide more space for storage and continue the accumulation of paper records. This practice was judged to be wasteful and shortsighted and in no way contributed to a solution of the second problem.

Review of the second difficulty, records wearing out from prolonged use, indicated that some substitute was needed for the original record. The use of microfilm, in lieu of the original record, appeared to have some advantages; it was a well-developed product enjoying wide use and acceptance, and it was relatively inexpensive. Further research revealed that under satisfactory storage conditions it was long lived. Microfilm appeared to be a possible solution to both problems.

A first important step was taken in 1948-49, when considerable effort was expended in the rehabilitation and transfer of all certificates to better filing equipment, in which the certificates are not bound. A State file number was stamped on all certificates. This number became an integral part of the indexing system, which is necessary to locate records or corresponding microfilm. The State file number is assigned as a consecutive serial number, 000001 through "n," for each type of record within each year of occurrence of event. The two digits representing the year of event are a part of the State file number and precede the six-digit serial number.

Several questions remained to be decided about the use of microfilm. What size film would be used? What reduction ratio was

most desirable? What kinds of equipment were most suitable? As answers were found for these questions, new ones were asked. The exploration of the possibility of using microfilm as a substitute for original records developed into a number of related studies.

Certificate References

Our two basic requirements for any solution using microfilm as a working record were ability of the film system to accommodate amendments at any time (3) and adaptability to production of photographic copies of the record from the film at all times. These two requirements limited the solutions which would be acceptable.

To understand better the first requirement it was necessary to measure amendments quantitatively. A certificate reference study (4) was undertaken for a 1-year period in which annual reference rates were established per 1,000 certificates by type and age of certificate. In the analysis of the rates, particular attention was given to the references made for the purpose of amending certificates. There was a relatively high activity of certificate references for a relatively short time after filing of the certificates for marriages and deaths and a high reference activity over a much longer period for certificates of live birth.

Since a substantial part of this high reference rate was due to amendments to the records, it became apparent that considerable expense could be avoided in splicing the microfilms by instituting what we call a minimum lag period of 15 years for births and 5 years for marriages and deaths before the permanent microfilm security copy and noncurrent working copy were prepared.

During this lag period, the current processing copy of the film, which is used as a processing medium, is placed in security storage within a few months after the certificates are registered and is retained until it is replaced with the permanent security copy which is prepared at the end of the lag period.

Film Systems and Amendments

We investigated the relative advantages of roll microfilm and microfilm card filing systems

in which a film image or images are inserted in a card which is then filed vertically in conventional card filing equipment. The latter system was rejected in favor of the former on two counts: the total cost of installing and maintaining a system for using microfilm filed in card form was much higher than for a roll form system, and the saving in storage space is greater when the roll system is used. Furthermore, we could find no real advantage to the card system except that it is a widely understood concept, whereas "rolls of records" is not.

These records are subject to amendment at any time. The amendment is, in fact, an accessory document. After amendment the record then becomes a two-document record. These accessory documents must be added to the rolls of film. The simplest and most economical method is to microfilm the amendments and splice them into the microfilm roll preceding the pertinent film image.

Splicing, Editing, and Reading

There are two basic methods of film splicing, lap-weld and butt-weld. The former is the conventional splice system, in which the ends to be spliced are trimmed, buffed, coated with cement, overlaid, and held together for a short time to allow the cement to dry. The butt-weld system trims the ends to be joined, brings them together so that the ends join perfectly (but do not overlap), then welds the ends together by applying heat for a brief interval at the point of contact of the two film ends. No cement is used. It was decided to use the butt-weld splice since it is much stronger and faster than the lap-weld splice.

No machine existed for editing nonsprocketed roll microfilm, yet it is a virtual necessity if the film is to be amended. We contrived our editing device by converting a commercially available editor made for sprocketed 16-mm. cinefilm.

We found many brands and styles of microfilm readers. Most were rather primitive by today's standards and were poorly designed in that little consideration had been given to wear and tear of film on its travels through the reader. The choice was finally narrowed to one reader. Several accelerated wear and tear tests

were done with this reader in an attempt to simulate the conditions which we expected our microfilm to survive. After several months it was concluded that attempts to reduce the wear caused by the reader were misguided; the film itself would not stand the usage we expected of it. At this point we became aware of recent developments in diazo-type film which, in essence, solved wear and tear.

Duplicates and Enlargements

The diazo film duplicate is necessary whenever the microfilm becomes an active working record. The film surface is so much harder than gelatin emulsion that we did not have to give further consideration to reducing film wear and tear by the reader and the microfilm editor. Also, the diazo film duplicate is less expensive than conventional silver halide emulsion film. For these reasons, we decided to use a diazo print for the working record. It was necessary to develop standards and specifications for preparation of diazo-type duplicate film since none have yet been completely developed and published (5).

The ability to produce paper enlargements readily and economically is a necessity. For many years there was no piece of equipment on the market which would do the job. For 7 years this problem was discussed with everyone we could find who could possibly help. Many persons offered concrete suggestions for the design of such equipment, but no suitable equipment was available.

Finally in 1953 the Photostat Corporation was induced to join in the development of a microfilm reader-printer. A factory-engineered prototype was installed for shake-down tests in mid-1954. The machine had many unacceptable features and was finally rejected in December 1954. It was then decided to develop the machine on the job. With the assistance of the Photostat Corporation, satisfactory equipment designed to our specifications was developed and has been in use since July 1956.

The reader-printer has all of the features of a microfilm reader and the capability of producing automatically photocopies of selected images in daylight. The reader device is an

adaptation of a Kodagraph Reader Model MPE. The photocopy device is an adaptation of a Photostat Junior Continuous Model A. The other significant elements of the reader-printer are a two-phase remote control timer, a variable transformer to control the output of the projection lamp, and an automatic certification printer with selective lockout.

With this machine the operator can rapidly find a desired record image and produce a certified copy merely by pressing a button. The cycling time is about 25 seconds.

Conclusion

With the completion of these studies and development of equipment, a specific proposal for a microfilm program met with administrative and legislative approval. During this process, necessary amendments were made to the State Health and Safety Code (6) and funds were appropriated to implement the program.

The essential parts of this program were put into operation in 1958. Following is the present procedure. Currently registered certificates of birth, death, and marriage are microfilmed on a rotary camera at a 17 to 1 reduction ratio on 16-mm. silver halide film. This film is used as a one-purpose current processing medium, that is, as a medium from which to punch tabulating cards from which statistical reports and indexes are prepared. The current processing film is filed in security storage within 2 or 3 months after receipt of certificates and serves as a temporary security copy until the permanent copy is prepared at the end of the lag period. During the lag period, the original certificates are used for all reference purposes, except for the key-punching medium.

After the lag period of 15 years for births and 5 years for deaths and marriages, a 16-mm. silver halide original film at a 17 to 1 ratio and a diazo duplicate film copy are prepared. The silver halide original film is placed in security storage, replacing the temporary security copy. The diazo duplicate film copy is used as the current working record. The diazo duplicate copy reflects all amendments on a current basis. Provision is made so that the silver halide security copy can, if needed, be used to prepare

another diazo duplicate which will reflect all amendments. The original records go to dead storage and can be destroyed on permissive legislative authority.

This system, designed primarily to use microfilm as a working record, has operated successfully now for more than 1½ years and appears to be an effective solution to the problem for which it was designed.

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- (6) State of California Health and Safety Code Sections 10036 and 10037, 1959.

Legal note . . . Sanitation

Municipality enjoined from operating an open burning dump so as to create a nuisance. *Proulx, et al. v. Keene* (158 A. 2d 455, New Hampshire, February 1960).

In accordance with a State statute, requiring New Hampshire cities and towns to maintain public dumping facilities, the City of Keene established an open burning dump on land within its boundaries.

Plaintiffs sought to enjoin the operation of the dump as a nuisance, complaining that it subjected them to substantial annoyance from smoke and odors, interfered with the enjoyment of their properties, and depreciated the value of their land.

The lower court found that charred and unburned paper and debris were blown from the dump onto lands of the plaintiffs. Frequent smoke and odors also occurred, which were at times "almost sickening to smell," caused a "burning" sensation of the eyes, and required that bedroom windows be closed and picnics be held indoors.

Appealing from the decision of the lower court granting an injunction, counsel for the City of Keene argued, among other things,

that the city, being required by State law to maintain the dump, could not be enjoined from performing its duties. The Supreme Court of New Hampshire disposed of this argument by pointing out that the State law specifically provided that the disposition of waste must be in such a manner as not to create a nuisance, and that the injunction did not prohibit the operation of the dump entirely but only its operation in such a manner as to permit the escape of smoke, odors, and debris to plaintiffs' lands.

The court noted that although the city was exercising a public right in performance of a public duty imposed on it, its use of its land could not be unreasonable as against adjoining landowners. In upholding the injunction, the court found that the evidence supported the decision that in this case the use of the land for a burning dump was unreasonable.—SIDNEY EDELMAN, assistant chief, Public Health Division, Office of the General Counsel, Department of Health, Education, and Welfare.

New Knowledge and Current Problems in Human Virus Infections

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FROM his most primitive existence, man's acquisition of knowledge, while helping to resolve existing problems, has created new and, at times, seemingly more complex problems which demand solution. This has seemed to be the effect of each increment to our knowledge of virus infections. As more viruses are discovered, the work of classifying, differentiating, and establishing the clinical significance of these agents becomes more intricate.

Until 1947, 60 viruses had been cataloged as producing illness in man (1) but only 18 of these were strictly human pathogens. The others, including the arbor or arthropod-borne viruses as well as viruses of other lower animals (zoonotic viruses) are not obligated to man for their parasitic existence. Thus, man served as the sole reservoir for but a small fraction of his virus infections. In 1947, the enterprise of Dalldorf and Sickles (2) in utilizing suckling mice for isolation of a pathogenic virus, other than poliovirus, from the stools of two upstate New York cases of suspected poliomyelitis opened the door to the identification, in the ensuing 10 years, of 19 types of Cocksackie A and 5 types of Cocksackie B viruses.

Although the Maitlands, several decades ago, pioneered tissue culture for the study of patho-

gens, the technique was complicated, if not formidable, since an additional animal host system was necessary to demonstrate that growth of virus had occurred. The major impetus to virus isolation and culture came with the discovery by Enders and his co-workers (3) in 1948 that clear-cut cytopathogenic effects indicating viral activity and growth could be demonstrated in tissue cultures directly, without the need for a secondary animal indicator system.

The virus utilized was the Lansing strain of poliovirus, and the in vitro hosts were roller-tube cultures of human extraneural tissue cells. Subsequently, monkey kidney tissue cultures and a variety of other types of cells growing in vitro, including HeLa cells, have been employed with good results.

In the 12 short years since the work of Dalldorf, a tremendous number of hitherto unrecognized viruses have been identified and serologically typed. Of these, 81 new types of human viruses have been isolated and characterized physically and serologically (table 1). This number is more than all the viruses, irrespective of reservoir, recognized in the preceding half century. Numerous new viruses from other animal sources (for example, ECMO, ECBO, ECCO, and arbor) have also been isolated; nearly every month brings new identifications.

In table 1, the viruses for which man is the principal or, more frequently, the sole reservoir are presented according to the period of their discovery and their group designation. The arborviruses are not included in the table, since, as far as we know, there are no exclusively

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human parasites among them, with the possible exception of dengue. Except for the reoviruses (4), a new group, group designations follow the recommendations of the 1953 Conference on Virus and Rickettsial Classification and Nomenclature of the New York Academy of Sciences (5); the classification adopted by the Sixth International Congress of Microbiology in Rome, in 1953 (6-8); the definition of the enterovirus group by the Committee on Enteroviruses, National Foundation (9); and the definition of the adenovirus group by the principal workers in this area (10).

Problems in Classification

Although the earlier prototypes of these several virus groups are almost exclusively associated with specific clinical entities, such as smallpox and mumps, clinical specificity is not generally associable with each specific long-established agent and can be linked even less readily with the numerous agents discovered recently. Thus, a suitable classification cannot be predicated upon clinical entities. The virus types are categorized in groups according to size and other physical characteristics, pathogenicity for certain animal tissues or tissue cultures, antigenic relationships, and certain special biochemical and other characteristics such as the reaction of the myxoviruses with mucoproteins on the surface of cells or a complement-fixing antigen common to all the adenoviruses (11).

The currently accepted classification obviously is influenced somewhat by the anatomic site in which members of a particular virus group are most commonly found. This is true for the adenoviruses (formerly called the adenopharyngoconjunctival group) and for the enteroviruses. It is not true for the herpesvirus, myxovirus, and poxvirus groups, nor for most of the types in the psittacosis group. For these, the group designations are morphological, pathogenetic, or biochemical in implication.

Since viruses of the herpesvirus, myxovirus, and poxvirus groups, with the one exception of molluscum contagiosum, have a respiratory localization, some investigators (12) have suggested a regrouping into enterovirus and respiratory tract virus categories, with the adeno-

viruses, myxoviruses, and certain other viruses as subgroups. This classification would also be far from ideal, for not only can enteroviruses be isolated from the oropharynx early in an infection and adenoviruses be found in the intestinal tract, but the enteroviruses produce a substantial amount of acute respiratory illness which may even represent the bulk of the clinically apparent infections with these agents.

Even pathogenicity for infant mice, used in separating the Coxsackie from the ECHO viruses in the enterovirus group, has generated new problems of differentiation and classification. Strains of ECHO types 9 and 10 have begun to behave like Coxsackie viruses A and B (9). In fact, the large size of ECHO 10, its rather distinctive cytopathogenic effects, the pathogenicity for mice of some of its strains, and the respiratory disease which it apparently produces in children have led to its removal from the enterovirus category and the rest of the ECHO tribe to a new group called the reoviruses, or respiratory-enteric group (4), where it stands as a prototype.

Some Coxsackie viruses (A9 and B) may not be pathogenic for infant mice, and in this way they simulate the ECHO viruses. Coxsackie A7 and A14 and also some ECHO viruses may produce lesions of the neurons in monkeys, thus simulating polioviruses (13). There is small wonder that before these characterizations were made, the Russians thought they had found a fourth type of poliovirus when they isolated a virus from the stool of a fatal case of clinical poliomyelitis and found it to be neurotropic in monkeys but not typable for polioviruses 1, 2, or 3. This virus has now been definitely characterized as Coxsackie A7 (14,15). These newly elicited interrelationships, despite serologic specificity of the poliovirus, Coxsackie, and ECHO tribes, are serving to obscure the demarcation lines originally drawn between the tribes. There is, therefore, increasing justification for grouping these three tribes together as enteroviruses.

Etiological and Clinical Specificity

Though these classifications tend to bring some order into the field of virology, they do not, unfortunately, simplify the problem of specific clinical differentiation and diagnosis.

Table 1. Distribution of human viral agents by type and period of discovery

Group	Known prior to 1947	Discovered since 1947 ¹
Adenovirus (10)-----	None	Types 1-18 (12).
Enterovirus (9)-----	Poliovirus (untyped)	Poliovirus types 1-3 (39). Coxsackie A types 1-19 (40). Coxsackie B types 1-5 (40). ECHO types 1-9, 11-24 (9, 40, 41).
Herpesvirus (5)-----	Herpes simplex Herpes zoster Varicella	None.
Myxovirus (6)-----	Influenza A and B Mumps	Influenza A prime (42). Influenza C (43). Parainfluenza group (44): Type 1: HA-2 (hemadsorption type 2) ² (45). Influenza D (Sendai) ² (46). Type 2: CA (croup-associated) (47). Type 3: HA-1 (hemadsorption type 1) (45). M-25 (48).
Poxvirus (8)-----	Molluscum contagiosum Smallpox	None.
Psittacosis (5)-----	Lymphogranuloma venereum	None.
Reovirus (4)-----	None	Type 1: ECHO 10 (4, 9). Types 2 and 3 (4).
Other-----	"Common cold" Homologous serum hepatitis Infectious hepatitis Infectious mononucleosis Measles Roseola infantum Rubella Trachoma	Respiratory syncytial virus (49). Salivary gland virus (50). JH virus (51). 2060 virus (52).
Total-----	18	81

¹ Since this paper was submitted for publication, Coxsackie A types 20, 21, 22, and 24; Coxsackie B type 6; and ECHO types 25, 26, and 27 have been isolated.

² Considered identical by investigators in the United States.

NOTE: Italicized figures in parentheses are reference numbers. References 39-52 do not appear in the text.

It has become quite clear not only that an individual member of the enterovirus, adenovirus, myxovirus, or other group can produce a diversity of clinical illnesses, but that a single clinical entity or syndrome may be produced by a number of specific virus types. Table 2 illustrates the virtual hopelessness of attempting etiological differentiation.

Although certain clinical entities have been carefully characterized, it must be remembered that the classic picture of a disease does not often obtain and that aberrant mild forms are quite common. Table 2 reveals several entities of a respiratory nature whose clinically differentiating characteristics may not always be present.

Acute undifferentiated respiratory disease (ARD) ranges from the severe form resembling primary atypical pneumonia to the mild ambulant form which, but for epidemiological and virus laboratory studies, would be classed as common colds. Within the spectrum of this entity, some illnesses may resemble influenza and others, acute pharyngitis.

Adenovirus types 4 and 7 have been incriminated as the etiological agents in military outbreaks of ARD (16). Although many adults eventually develop antibodies to these types, suggesting sporadic or even endemic infections, civilian outbreaks have not been documented, and these serotypes are rarely found in children. In addition, adenoviruses have not been

Table 2. Association of enterovirus, adenovirus, myxovirus, and other

Illness	Enteroviruses			
	Polio types	Coxsackie A types	Coxsackie B types	ECHO types
Paralysis (complete to slight muscle weakness)-----	1, 2, 3	7, 9	3, 4, 5	2, 4, 6, 16
Myocarditis or encephalomyocarditis (neonatal and early childhood)-----			2, 3, 4	
Epidemic pleurodynia-----			1, 2, 3, 4, 5	
Herpangina-----		2, 3, 4, 5, 6, 8, 10, 16		
Aseptic meningitis-----	1, 2, 3	7, 9	1, 2, 3, 4, 5	2, 3, 4, 5, 6, 9, 14, 16
Epidemic exanthems:				
Boston exanthem and summer rash-----		16		4, 9, 16
Meningoencephalitis with rash-----				9
Summer diarrhea-----				18, 19
Acute febrile respiratory disease (summer grippé) most common-----	1, 2, 3	Many types	Many types	Many types
Acute undifferentiated respiratory disease-----				
Acute laryngotracheobronchitis-----				
Acute febrile pharyngitis-----				
Pharyngoconjunctival fever-----				
Follicular conjunctivitis-----				
Epidemic keratoconjunctivitis-----				
Viral pneumonia:				
Infants and children-----				
Adults-----				
Cytomegalic inclusion disease-----				

¹ Adapted from several sources (9,12).

CCA—Chimpanzee coryza agent, or respiratory syncytial virus.

SGV—Salivary gland virus.

isolated from more than a very small percentage of cases of similar illnesses in civilian families (17). Rhodes and Van Rooyen (18) also feel it unlikely that more than a small percentage of colds occurring in the civilian population are due to adenoviruses. Even in military outbreaks a "large proportion of cases of typical ARD shows no evidence of infection with adenoviruses, and its etiology remains unknown" (19).

Furthermore, the enteroviruses, including poliovirus, are quite frequently responsible for undifferentiated febrile illness, often with respiratory symptoms (9).

In an extensive epidemiological and virological study of poliomyelitis in Minnesota in 1955, 1,272 fecal specimens from family contacts of poliomyelitis patients were examined for virus. Of these, 469 specimens were from family contacts of 175 patients from whom poliovirus had been isolated. One hundred and eighty-eight

(40 percent) of the 469 specimens were positive for poliovirus.

In table 3, the 469 contacts are distributed according to their symptoms elicited in the course of surveillance. Only 109 showed any symptoms. The "pharyngeal" group, constituting 54 percent of the contacts showing any symptoms, included those with sore throats or history of a "cold." The "fever" group included those with fever alone or fever and other symptoms not included in the pharyngeal or meningeal complex. It is of interest that poliovirus was isolated from 63 percent of the contacts with pharyngeal symptoms.

From these several documentations and observations it is abundantly clear that the clinical illnesses of respiratory character presented in table 2 cannot be ascribed to a solitary virus group. Thus, clinical differentiation with etiological overtones is not possible without virus laboratory definition.

virus types with human illness ¹

Adenovirus types		Myxovirus types	Other types
Common	Less common		
4, 7	3, 14	Parainfluenza 1, 2, 3.	JH, 2060, CCA.
1, 2, 3, 5		Parainfluenza 1, 2.	
3, 7a	1, 2, 5, 6, 14	Parainfluenza 3.	
3, 7a	2, 6, 9, 10		
8 (classic)	3, 7a (mild)		
7a	1, 3	Parainfluenza 1, 3.	CCA.
4, 7	1, 3		SGV.

An analogous situation prevails for illnesses predominantly referable to the central nervous system (CNS).

In the happy, unenlightened first quarter of this century, poliovirus infections leading to paralysis were much more frequently recognized and reported than nonparalytic forms. This was so despite the careful description of abortive forms of poliomyelitis by Wickman in 1907 (20) and the reiteration by Lavinder, Freeman, and Frost (21) in 1918 that poliomyelitis very frequently occurs without paralysis.

However, by the fifth decade of this century, recognition of nonparalytic poliomyelitis based on signs of meningeal involvement during the poliomyelitis season had become universal in the United States. In Minnesota, for example, in the period 1947 to 1953 the proportion of nonparalytic to paralytic poliomyelitis reports stabilized at approximately the 1:1 level (22). From time to time, outbreaks of predominantly

nonparalytic poliomyelitis were recorded. The Illinois Department of Public Health records for 1951 show, for instance, that of the more than 100 cases of poliomyelitis occurring in Champaign County only an extremely small percentage were paralytic. Although such outbreaks were considered most unusual, facilities were not then available in Illinois for laboratory differentiation of the viruses involved.

It was only in the late forties that the work of Dalldorf and of Enders opened up new techniques for virus isolation, and still later that workers began to isolate hitherto unknown viruses from cases of central nervous system infections and other related diseases. Causal relationships began to be clarified through these techniques, which also permitted simplified and economical antibody titration.

As late as 1955 in Minnesota, however, the actual cause of much nonparalytic disease involving the central nervous system, which was then being diagnosed as nonparalytic poliomyelitis, could not be determined. Whereas poliovirus was isolated from 75-90 percent of the cases of paralytic poliomyelitis in 1955, only 13 percent of the so-called nonparalytic poliomyelitis cases yielded poliovirus isolations. Although antibody studies verified an additional percentage of true cases of nonparalytic polio, a significant number of cases remained etiologically unexplained. In retrospect, at least some of these could have been caused by Coxsackie or ECHO viruses.

Again in the late forties, Wallgren's diagnosis of "aseptic meningitis" (23), originally designed to differentiate nonspecific or allergic meningitis from specific infections of the central nervous system, regained favor. The nonspecific character of the diagnosis of aseptic meningitis recently has been reaffirmed by the large number of polio, Cocksackie, and ECHO viruses found to be responsible for nonparalytic central nervous system disease (table 2). Thus, aseptic meningitis, a syndrome rather than a specific disease entity, bears no etiological significance without laboratory-determined agent designation.

To add to the problems of clinical differentiation engendered by a diversity of agents, the recent demonstration of transient mild paralysis accompanying Coxsackie A7 and A9 infections,

as well as infections with ECHO types 2, 4, 6, and 16, and the demonstration of polioli-like lesions in mice and monkeys infected with Coxsackie A7 and A14 viruses (13) have complicated the picture of paralytic polio also. Even in the face of paralytic phenomena, a clinical diagnosis of poliomyelitis can be treacherous except under epidemiological conditions to be noted later.

Diagnosis of the time-honored exanthemata has also been affected by the problems unfolded in recent virus research. In 1951 in Boston, and again in 1954 in Pittsburgh, Neva and others (24,25) studied outbreaks of a febrile exanthem in which a pink maculopapular rash appeared on the face, trunk, and limbs, along with muscle pain and headache. The agent isolated on human fibroblast cultures has now been identified as ECHO 16.

In England, during the summer of 1954, viruses with the characteristics of the ECHO group were isolated from 5 of 6 stool specimens of infants, 3-14 months of age, who were exhibiting irritability, fever, a maculopapular rash, superficial lymphadenopathy, vomiting, and diarrhea. But for pleocytosis of the cerebrospinal fluid, these illnesses could readily have been confused with rubella (26).

Since then, a number of outbreaks have been reported in which symptoms and signs referable to aseptic meningitis were complicated by rashes variously described as rubelliform

(27-32) and scarlatiniform (33). In all these outbreaks, ECHO 9 strains were isolated. Since rash was a symptom in only 30-40 percent of the cases identified as ECHO 9 infections, it is obvious that the majority of the cases presented aseptic meningitis syndrome only. Without the correlative laboratory isolations of ECHO 9 virus, outbreaks of two separate diseases might have been inferred. In fact, in the early weeks of the Minnesota 1957 outbreak of ECHO 9 aseptic meningitis, the largest to date, with 424,000 cases extrapolated from a random sample family survey (31), one local health officer did derive this inference; with considerable concern, he stated that in his area he had two epidemics going at the same time—one of nonparalytic polio and the other of Boston exanthem.

Epidemiological Implications

It is obvious that the isolation of 24 types of Coxsackie and at least 24 types of ECHO viruses, many of which are responsible for acute central nervous system infections frequently occurring in outbreak form, has made the diagnosis of nonparalytic poliomyelitis almost impossible to establish clinically. The significance of this difficulty in the evaluation of vaccine efficacy and in epidemiological investigations in general is also quite obvious. Surveillance programs for central nervous system infections, as a result, have had to be coupled with services of a competent virus diagnostic laboratory. Only the laboratory can define an entity etiologically when the syndrome can be produced by a variety of agents. The same principle applies to the entire field of new virus infections, whether they produce CNS, gastrointestinal, or respiratory disease.

The necessity for observing the principle with CNS diseases impressed itself upon us in Minnesota in 1955, when Salk polio vaccine was applied to a virgin population. Questions of safety and efficacy required the establishment of a surveillance program for CNS infections (22).

Physicians and hospitals were highly co-operative, not only in reporting, but in the submission of stools and paired blood samples from their patients. Health department and county

Table 3. Poliovirus isolations from family contacts of patients from whom poliovirus was recovered, according to symptoms of contacts, Minnesota, 1955

Symptoms of contacts	Number of contacts	Poliovirus isolations	
		Number	Percent
Any symptoms.....	109	72	66
Pharyngeal group.....	59	37	63
Meningeal group.....	13	6	46
Fever group.....	37	29	78
No symptoms.....	360	116	32
Total.....	469	188	40

SOURCE: Studies by the school of public health, University of Minnesota, and the department of bacteriology and immunology, Minnesota Department of Health.

nurses and medical students obtained clinical histories and stool specimens on all family contacts of patients with CNS infections. Stools were examined for virus, utilizing HeLa cell cultures, and paired serums were examined for antibody titer increases. Exclusion tests for mumps, St. Louis and western encephalitis, and for lymphocytic choriomeningitis were also applied. A search for Coxsackie and ECHO viruses was not part of the laboratory routine in 1955, although 27 cytopathogenic agents were isolated from patients or contacts and identified the following year.

Six hundred and forty-nine cases of CNS disease, the total State caseload, were processed in 1955. Table 4 compares the originally reported diagnoses for these cases of CNS disease with the final diagnoses established after completion of either virus isolation, or antibody titrations, or both.

The physicians who reported cases as paralytic poliomyelitis were correct 152 out of 163 times, or for 93 percent of the cases so reported. However, only 269 (59 percent) of the 457 cases originally reported as suspect poliomyelitis or nonparalytic poliomyelitis were finally designated as nonparalytic poliomyelitis. The remaining nonparalytic or suspected poliomyelitis cases were ultimately distributed among paralytic poliomyelitis (55 cases); mumps encephalitis (24 cases); lymphocytic chorio-

meningitis (4 cases); aseptic meningitis (45 cases); and other illnesses, including Guillain-Barré syndrome, bacterial meningitis, and transverse myelitis (60 cases).

Aseptic meningitis in this study was a diagnosis ascribed to cases which fulfilled all the following criteria:

1. No poliovirus isolated from submitted stools.
2. Absence of paralysis.
3. Absence of serum antibodies to any type of poliovirus.
4. Failure to establish a diagnosis of other etiologically definable CNS disease by serologic methods.
5. Pleocytosis in cerebrospinal fluid.
6. History of meningoencephalitic symptoms.

Of 25 cases of mumps established serologically, only 1 had been initially diagnosed clinically. In 14 of these cases, there was either a history of recent parotitis or parotitis developed shortly after report. The other 11 cases were without parotitis. Furthermore, although physicians reported infectious encephalitis 16 times, none was confirmed for western or St. Louis types.

This study indicates that although paralytic disease is still preponderantly poliomyelitis and, in the face of an outbreak of paralytic disease, the physician's clinical impression of poliomyelitis most frequently proves to be cor-

Table 4. Comparison of originally reported diagnoses with final diagnoses in CNS cases investigated during poliomyelitis surveillance in Minnesota, 1955

Originally reported diagnoses	Final diagnoses							Total
	Paralytic poliomyelitis	Nonparalytic poliomyelitis	Mumps	Lymphocytic choriomeningitis	Aseptic meningitis	Western and St. Louis encephalitis	Other	
Suspect poliomyelitis.....	19	85	19	1	15	0	54	193
Paralytic poliomyelitis.....	152	5	0	1	0	0	5	163
Nonparalytic poliomyelitis....	36	184	5	3	30	0	6	264
Mumps.....	0	2	1	0	0	0	1	4
Lymphocytic choriomeningitis	0	1	0	0	0	0	0	1
Aseptic meningitis.....	0	7	0	0	1	0	0	8
Western and St. Louis encephalitis.....	0	4	0	0	1	0	11	16
Total.....	207	288	25	5	47	0	77	649

SOURCE: Studies by the school of public health, University of Minnesota, and the department of bacteriology and immunology, Minnesota Department of Health.

rect, his "batting average" for nonparalytic disease is quite disappointing.

Another important epidemiological implication of the isolation of numerous viral agents is their temporal distribution in communities. Although the newly discovered enteroviruses, adenoviruses, and myxoviruses, by direct isolations and evidence of specific antibodies in serums, have been shown to occur in all parts of the world, specific communities experience rises and declines in the amount of infection and disease caused by these agents.

Observations in Minnesota reveal a provocative reciprocal interdependence of predominating enterovirus types year by year. With continuing poliomyelitis surveillance by the Minnesota Department of Health, CNS disease is thoroughly investigated and stool and other specimens are examined for virus content. After typing, confirmations are performed by the virus laboratory of the University of Minnesota department of bacteriology and immunology under the direction of Dr. J. T. Syverton.

Table 5 presents the Minnesota enterovirus experience for the years 1955 through 1958. In each year a specific enterovirus type predominated almost to the exclusion of others. In 1955, poliovirus predominated; in 1956, Coxsackie B5 was apparently responsible for the bulk of the CNS cases; in 1957, the largest recorded outbreak of ECHO 9 meningoencepha-

litis with rash occurred; and in 1958, Coxsackie B5 returned. Although data on virus isolations are not complete, poliovirus was apparently in ascendancy in 1959, with preliminary reports through December 31 indicating that of 237 cases reported, 198 (84 percent) were paralytic. Furthermore, most of the recent incidences and outbreaks of poliomyelitis have been either solely, or at least predominantly, of one type.

The significance of these data is not clear. Is this a pure chance interdigitation of separate and distinct secular cyclings of the several agents? Or is an interference phenomenon, repeatedly documented in the laboratory for such pairs of agents as one poliovirus type and another one of its heterotypes (34-36), and poliovirus and Coxsackie B (37), operating outside the laboratory? If such interference is, in fact, occurring in nature, then the implications for vaccination, especially with mixtures of live viruses, may be quite important.

Viruses Still in Search of Disease

Referring again to table 2, it is immediately apparent that not all of the isolated new viral agents have been incriminated in human illness despite their isolation from human sources. For example, although 18 adenovirus types have been isolated, only 11 of them have been established as productive of human illness. In the Coxsackie A group, only 10 of the 19 types have been incriminated, and of the 24 ECHO types, approximately 10. Many of the viruses which have not yet been causally related are the more recent discoveries, and it is highly probable that such relationships will ultimately be established for a number of them. Furthermore, there is every reason to believe that new types will continue to be isolated and, as aberrant characteristics are elicited, new groups formed. It is likely that viruses will continue to be in search of disease.

The establishment of causal relationship between the many new virus types and human disease is a complex operation. We find ourselves at present in the same position with virology as we were with bacteriology in the early years of this century, when any bacterium isolated from a patient was considered the

Table 5. Isolations of enteroviruses from CNS and related cases in Minnesota, 1955-58

Virus isolated	Year			
	1955	1956	1957	1958
Polio.....	¹ 175	47	9	12
Coxsackie:				
A 9.....	0	2	4	2
B 2.....	11	0	2	0
B 3.....	4	6	1	2
B 4.....	0	0	1	2
B 5.....	0	60	18	109
ECHO:				
1.....		0	6	0
6.....		0	2	1
9.....		0	149	5
Total.....	190	115	192	133

¹ Excludes isolations from 188 family contacts.

cause of his disease. Time proved many organisms to be nonpathogenic; there may also be a normal viral "flora."

Merely finding an adenovirus in throat washings or an enterovirus in the stool of a sick patient does not establish a causal relationship. Their isolations may be coincidental, and several types may be isolated from the same patient during the same illness. Even a rise in antibody titer for a given viral type is not in itself proof of causation, for hetero-type responses may occur. Most of the studies attempting to relate agents to disease have involved isolations from throat washings or stools, and there are those investigators who would demand viremia, rarely encountered, as proof.

There is even some evidence that virus recovered from an anatomic site of disease may not be adequate proof that the isolated virus is the cause. Melnick (38) cites the finding by Israeli investigators of Coxsackie virus in the spinal fluids of two patients with brain tumor and suggests that even penetration of the blood-brain barrier would thus not constitute proof of causality.

The highly frequent finding of the agent in cases of a disease with clinical distinctness and its absence from cases of other illnesses is suggested as a first step in establishing etiology. That this would not often be achieved in markedly similar syndromes has already been implied in our discussion of clinical specificity.

However, the markedly higher incidence of a given virus in patients with a given syndrome than in healthy controls selected from a comparable segment of the population would constitute strong incriminating evidence. The isolation of a virus, its production of the specific disease in volunteers, and recovery of the virus from the newly induced cases (with suitable controls) would be the ideal method but for the fact that, for a number of agents, infection takes place early in childhood and results in immunity.

No single one of these criteria, with the exception of the controlled volunteer study, would in itself constitute proof of an etiological relationship, but, in the aggregate, a strong association could be surmised. Sporadic cases, or even very small groups of cases, would rarely

provide us with an aggregate of positive criteria. Since causality, in the last analysis, is a matter of inference drawn from repeated strong associations, epidemics of disease provide us with the type of material necessary for the establishment of etiological relationships. In this regard, then, not only does the epidemiologist need the virologist and the clinician, but for a long time to come, the virologist and the clinician will need the services of an epidemiologist.

At the present time, despite the tremendous gains in understanding achieved in the past 12 years, our knowledge of the relationship of the newer viral agents to illness in the human population rests just above the primitive level. We can be confident, however, that within not too many years, certain "orphans" will have found a home even though some of them will prove to be commensals without behavior problems.

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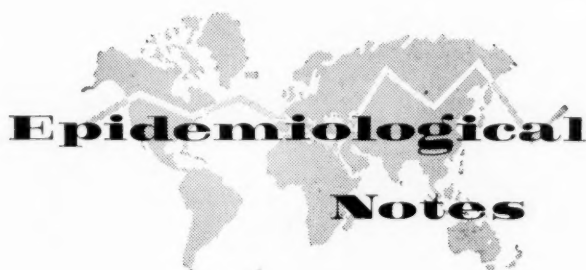
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Carcinoma in Blackfoot Indians

During the past 5 years, 1955-59, while carcinoma of the cervix uteri and carcinoma of the breast has been occurring with about equal incidence in the United States, carcinoma of the cervix has been found in some 12 women of the Blackfoot Indian tribe of Montana. This compares with only two Blackfoot women who in the comparable time period have been found to have carcinoma of the breast. The exact significance of this difference is not understood, and may be more apparent than real since it has only been during the past 3 years that any exten-

sive screening has been done for carcinoma of the cervix in this Indian group. Vital statistics for 1957 show about 3 to 4 deaths from cervix cancer to 1 death from breast cancer among all Indians.

The average Blackfoot Indian population on reservations during this time period has remained constant at about 4,000 enrollees, of whom approximately 1,000 were women in the age group above 20 years. The diagnoses of cervical carcinoma were all made after the women presented symptoms. Ages ranged from 24 to 39 years. One of the breast carcinomas was discovered during a routine physical examination. Both of the patients with breast carcinoma were more than 60 years old.

The members of the tribe are becoming increasingly aware of the need for periodic screening for carcinomatous conditions.

In addition to the above mentioned lesions, carcinoma of the lung, kidney, gall bladder, stomach, and tongue has been seen in members of the Blackfoot Indian tribe during the same 5-year period.—
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Findings of a Survey of X-Ray Units

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A FIELD survey of X-ray units used by all types of practitioners for diagnostic work was made in Oregon during 1958 and 1959 as part of the State's recently developed radiological health program. Results of this survey, along with a summary of the efficacy of steps that can be taken to protect the population from unnecessary exposure, are presented in this paper. Administrative and technical details of the survey have been published (1,2).

The survey sample included approximately 25 percent of the facilities used by an estimated 3,000 physicians, dentists, chiropractors, veterinarians, osteopaths, and chiropodists in Oregon. With the assistance of professional biostatisticians, the sample was picked to be representative of the State on a geographic and community-size basis.

Little if any systematic geographic variation was found in protection standards, nor did community size influence the findings in a predictable way. However, we did note that certain medium-size communities where local radiologists had made a special effort to improve protection appeared to be above the average.

The number of physicians of each type contacted and estimates of their caseloads are shown in table 1. In the absence of registration in Oregon, lists of practitioners were compiled from professional society registers and from the classified telephone books. We then picked a series of representative communities and called on every practitioner in the commu-

nity. During each visit we asked for an estimate of caseload, categorized as adult and pediatric patients, X-rays and fluoroscopy, X-ray pelvimetry studies, and other examinations. The data from hospitals were usually confirmed by examination of the daily work-book, but in many other offices we relied on estimates provided by the practitioner or technician. The average weekly caseloads for some practitioners seem surprisingly small, but at present there does not seem to be any way of verifying the number. In some areas it may be possible to obtain data on total sales of X-ray film.

Because of the comparatively small number of radiologists' offices outside of hospitals, we have included them within the category of "hospitals and radiologists." Hospitals (or oftentimes larger clinics in outlying communities), where the X-ray work was not supervised by a radiologist, are tabulated separately.

Protective Practices

Table 2 offers a statistical summary of protective practices observed.

In regard to "Operator and assistants well protected during fluoroscopy," we found quite reasonable protection. The hospitals and radiologists were uniformly good on this point. In some of the smaller offices with fluoroscopes, gloves or aprons or both were unavailable. We also evaluated leakage around the unit or through the viewing glass and the presence of assisting personnel in connection with this item. Grossly dangerous fluoroscopic units were rarely encountered, such as one that produced 65 r a minute at the tabletop in air and was used without an apron and with cloth (non-leaded) gloves.

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It does not appear that there are many offices today where exposure is grossly in excess of present-day occupational standards, though there are a few where protective action is urgently needed. Film badges should be used much more widely to provide accurate documentation of all potentially exposed individuals and also to serve as a protection for the owner in case of legal action at a later date. We found rather widespread interest in personnel protection, although some older technicians and practitioners still consider it superfluous.

The item "Personnel shielding available" was evaluated with cognizance of stated caseload, giving some consideration to any probable increase in work during the next year or two. In an office using the X-ray unit for only a few limb or chest exposures a week, for example, special added personnel protection devices might not be considered necessary. The low level of exposure under these conditions has been substantiated by experience with film badges as reported in the literature (3-5). Thus, the high score attained by certain classes of practitioners may reflect the lack of need for such devices rather than the actual availability of personnel shielding.

The third item "Personnel dosimetry provided" appraised the actual documentation of

exposure in offices, even where exposure was suspected to be negligible. From the practical standpoint, this was interpreted to mean that film badges should be used to document personnel exposures, but not necessarily on a continuous basis. Occasionally, in hospitals, pocket ionization chamber dosimetry was encountered and considered acceptable. As is seen from table 2, documentation of exposure is inadequate except in hospitals. Use of dental films for personnel monitoring was considered to fulfill the criteria for this item in some cases, but dental films are not really satisfactory for personnel monitoring.

Patient Exposure

The data on patient exposure were chosen out of a large and complex mass of information. "Satisfactory collimation in routine use" was evaluated with consideration of the types of examinations done in the office, the size of cones, their number, presence of diaphragms or variable aperture collimators plus correct use of equipment. The mere presence of three cones in an office, of course, is not enough to assure "satisfactory coning." They must be used at all times, and they must be exactly the right size. The more convenient variable aperture collimators were found in many hospitals and radiologists' offices and in a few other offices.

Table 1. X-ray users, machines, and estimated weekly caseload, Oregon survey, 1958-59

Item	Hospitals and radiologists' offices	Hospitals and clinics without radiologists	Physicians other than radiologists	Dentists	Osteopaths	Chiropractors	Veterinarians	Total
Total number of potential users ¹	58	10	331	244	60	21	26	750
Portland	40	2	199	144	41	13	16	455
Salem	7	0	97	60	10	6	4	184
Smaller towns ²	11	8	35	40	9	2	6	111
Total number of machines studied	81	10	107	170	44	7	22	441
Portland	56	2	62	85	32	6	16	259
Salem	14	0	26	52	4	0	3	99
Other towns	11	8	19	33	8	1	3	83
Estimated radiographic examinations per week ³	4,400	170	2,800	7,500	(4)	⁴ 150		15,000
Estimated fluoroscopic examinations per week ³	700	30	840		(4)	(4)		1,600

¹ Represents nearly 25 percent of the estimated total of X-ray units in the State.

² Smaller towns included Oregon City, The Dalles, Bend, Burns, Seaside, Woodburn, and others.

³ The best estimates of actual weekly caseload in the entire State are 50,000-60,000 radiographic examinations per week and 5,000-6,000 fluoroscopic examinations per week.

⁴ Inadequate data.

For dentists, the criterion was a field size $2\frac{3}{4}$ inches or less in diameter at the tip of the pointer. For veterinarians, we thought it desirable to have some coning to limit scatter, but this was not considered critical as to size. For chiropractors, we used the same criteria as were applied to physicians.

The next item appraises filtration for radiographic work. The criteria used, 2.5 mm. total aluminum equivalent filtration for medical units and 1.5 mm. for dental units, are the values required by the NCRP standards and widely advised in the pertinent literature (6-9). Some dental units, particularly certain new models, need no added filter because of adequate inherent filtration. Veterinarians' units were subjected to the usual filtration standards so as to decrease scatter and other operator exposure.

Film processing was routinely evaluated. We frequently encountered 2-3½-minute development times, especially in dental offices. Special consideration was given to instances where the developer was normally kept at a higher temperature than 68° F. and where, therefore, full processing might occur in a shorter time. Occasionally 3½-minute development was considered acceptable for offices with small case-loads and where temperatures were actually measured and normally found to be above 68° F.

The kilovoltage used by Oregon practitioners was appraised. It must be stressed that this tabulation does not deal with true high kilovoltage technique, which means exposure in the range of 90 kilovolts and above for all thick parts. We obtained uniform data on the kilovoltage used for a posteroanterior projection of the chest and for a lateral projection of the lumbar spine which serve as two important typical exposures. The kilovoltage was judged "medium" if it was above 70 for the chest film and above 75 for the spine film. These figures were chosen on the basis of experience and consultation with radiologists. We found that many of the older machines are used at lower values. Some of them cannot be operated in the 75-90 kilovoltage range, which we recommend for all thick parts, but much more commonly the kilovoltages in use were simply taken from old exposure charts provided with the unit.

In connection with kilovoltages, it is pertinent to study table 3, which gives exposures associated with an ordinary A-P film of the pelvis.

Dose Rates

For fluoroscopy we used a criterion of less than 10 r per minute for the table-surface dose rate, as set by the NCRP (9). Substantially

Table 2. Percentage of X-ray users fulfilling protection criteria, Oregon survey, 1958-59

Protection criteria	Hospitals and radiologists' offices (81 units)	Hospitals and clinics without radiologists (10 units)	Physicians other than radiologists (107 units)	Dentists (170 units)	Osteopaths (44 units)	Chiropractors (7 units)	Veterinarians (22 units)
Operators and assistants well protected during fluoroscopy	97	84	82			66	23
Personnel shielding available	95	50	80	40	68	70	32
Personnel dosimetry provided	93	50	20	43	11	0	68
Satisfactory collimation used routinely	84	25	39	22	32	14	18
Adequate filtration for roentgenography ¹	91	50	38	38	29	0	9
Satisfactory development of films	68	50	56	18	39	57	5
Kilovoltage in medium range	80	50	33	4	18	0	0
Fluoroscopic dose rate below 10 r/min.	97	66	62				50
Fluoroscopic filtration equal to 2.5 mm. aluminum	88	50	46				

¹ 1.5 mm. aluminum total equivalent, the standard established by the U.S. National Bureau of Standards in Handbook No. 60, was the criterion used for dental machines, and 2.5 mm. total filtration was considered satisfactory for medical radiographic machines.

lower exposures are possible and practical. The dose rate was measured with a condenser roentgen meter. Not many dose rates above 20 r/min. were found, but a fair number fell into the 10-20 r per minute range. On the other hand, satisfactory results were being obtained by many radiologists and some internists at 1-3 r/min. The recorded dose rate depends on the milliamperage used at the time of the measurement, and there is some variation in this parameter in practice. Most hospitals and radiologists had low fluoroscopic dose rates with satisfactory filtration. Units used by physicians other than radiologists were much less satisfactory in this regard.

Fluoroscopic dose rates were sought for veterinarians because of possible exposure to hands during animal examinations.

About a dozen pediatric fluoroscopes were encountered in the survey, most of which were used by several pediatricians practicing together in a clinic. The average dose rate was close to 10 r a minute and shuttering mechanisms were frequently unsatisfactory. Extensive recommendations were made on all these machines (often specially built from old X-ray parts), and in several places they were taken out of use entirely when the pediatricians

learned of the exposure hazard. It is believed that a single pediatric fluoroscopy can equal or exceed the 10 r value which is suggested as the limit for the average 30-year gonadal exposure of the population (10). We found it exceedingly difficult to obtain satisfactory data on the frequency of pediatric fluoroscopy.

The table does not include data on local shielding, partly because it was found so infrequently. Plain lead strips were available in many hospitals and radiologists' offices, but we have not been able to judge how frequently they are used as gonadal shields. Lead strips or sheets were rarely found in any other types of offices. Because of the limitations of coning, we feel it is most important to recommend careful gonadal shielding for all persons under 40. Gonadal shielding must, in our opinion, be provided as an adjunct to coning for the most critical abdominal and pelvic examinations.

Table 3 shows the effects of a series of modifications on the doses of radiation a patient would receive in an ordinary X-ray of the pelvis (7, 8, 11-13). It should provide some perspective on the importance of protective recommendations. Added filtration and higher kilovoltage have somewhat the same effect in

Table 3. Effects of technical improvements on radiation doses received from anteroposterior projection of the pelvis ¹

Kilovoltage	Added filter (mm. Al)	Altered parameter	Air dose		Depth dose at 8-9 cm.	
			Roentgens	Percentage of original value	Roentgens	Percentage of original value
60	None	Original conditions ²	4.0	100	0.36	100
60	None	Full 5-minute development.	2.4	60	.22	60
60	0.5	Minimal filtration	1.8	45	.22	60
60	3.0	Full filtration	.5	12	.11	30
85	None	Increase kilovoltage	1.2	30	.22	60
85	3.0	Increase kilovoltage and full filtration.	.3	8	.11	30
85	3.0	Fast film	.2	5	.07	19
85	3.0	Fast film and cassette screens.	.13	3	.05	14
100	3.0	High kilovoltage technique.	.08	2	.03	8
		From commonly found technique to good modern technique.	Change of 4.0 to 0.13 r at skin.	Decrease to about 3 percent.	Change of 0.36 to 0.05 r at ovaries.	Decrease to about 14 percent.

¹ Based on data in references 7, 8, 11, 13. All numerical estimates have been rounded off and are subject to some variation from machine to machine.

² Underdevelopment at 3 minutes, standard speed film, par-speed cassette screens.

that they "harden" the X-ray beam and reduce the skin dose relative to the exit dose. The usual exit dose for ordinary radiography is in the order of 25 to 50 mr, indicating that most of the radiation is absorbed by the body. Use of 85 kilovolts and 3.0 mm. of aluminum filter reduces the skin dose to about 12 percent of that received at 60 kilovolts without a filter. The depth dose changes less because of the filtration effect of the preceding soft tissues themselves, but nonetheless decreases as much as 50 percent. Addition of fast film and fast cassette screens to the above results in a drop to about 5 percent of the original dose at the skin and about 25 percent of the original dose at the approximate depth of the ovaries. If faulty development was also present initially, the reduction by improved film processing is to about 3 percent and 14 percent respectively. These reductions in exposure do not decrease film quality; in fact, there is usually an improvement. For the scrotum, in an A-P view, the decrease in gonadal dose approaches that in air dose, because of the relative absence of intervening tissue.

The effect of coning is not considered in table 3 because collimation of any sort would not adequately protect the gonads during a pelvic X-ray examination. Local shielding, however, may be of help if used properly. In general, exclusion of the gonads from the direct beam will decrease gonadal exposure by at least 90 percent and often even more (14). Therefore, coning and local shielding are of critical importance and heavy stress should be placed on them in control work.

Genetic Exposure

To appraise fully the steps advisable to protect patients from genetic damage, it is necessary to know their age and reproduction probabilities. It is also necessary to know what classes of practitioners are making the radiation exposures. Such information is not presently available, though many carefully conceived approximations have been made (10, 15, 16). Since reproduction is generally considered to be 50 percent complete by about 30 years and 90 percent complete by about 40 years, the genetic exposures of healthy individuals should

be carefully considered up to age 40, rather than 30.

In general, available data indicate that a small percentage of examinations, those of the lower trunk, contribute the great majority of gonadal exposures. For example, in a study of the entire population of Oak Ridge (17) it has been reported that 5 percent of all examinations contributed 80 percent of exposure to the gonads. The most significant procedures include views of the hips, pelvis, lower spine and sacrum, large bowel, genitourinary system, and full spine. In the Oak Ridge study, chest X-rays constituted 80 to 85 percent of all X-rays but contributed only about 17 percent to the total gonadal exposure. All the remaining views made up the small remaining percentage of examinations. The study did not evaluate pediatric X-rays or X-rays in chiropractic offices, nor give full breakdown by age, but nonetheless it is probably representative.

Somatic Exposure

It is very difficult to appraise the potential somatic hazards of radiation exposure at the present time. Integral body dose computations are more precise in some respects, but are critically dependent on the tissue exposed. Much recent literature evaluates gonadal and integral bone marrow doses as the two most important general criteria for probable biological damage (16). It may be noted that trunk X-rays or fluoroscopies which irradiate the gonads also tend to give heavy (though local) bone marrow doses.

At present there is inadequate information on the percentage of these critical examinations done on patients in various age categories. The available information suggests that their frequency is at least 2 to 3 times higher in those over 30 years than among younger persons.

Recommendations

On the basis of the above findings we advocate the following approach. Primary attention should be focused on all pediatric fluoroscopy and childhood X-rays involving the trunk, chest X-rays of all types, X-rays of the lower trunk region in individuals under 40 or

in anyone with a reasonably high reproductive potential. X-ray pelvimetry and other exposures of mother and fetus are particularly important because they heavily expose the sensitive fetus or embryo and the maternal and fetal gonads. On the other hand, less detailed attention needs to be given X-rays of extremities or head or both and to unusual special procedures, such as angiography, which are done on sick persons; also to X-rays of a type done predominantly on older persons. For instance, a large percentage of male genitourinary studies are done with patients past the age of 40 for whom local shielding is less important. The value of having these considerations clearly in mind is that one can make a more reasonable request of the practitioner, namely, that he use the cumbersome and bothersome local shielding only where it is distinctly indicated.

The complex situation discussed above demonstrates that all types of practitioners will have to give their full cooperation to produce a real reduction in genetically significant radiation exposure. A single spinogram (full-length X-ray of spine) may produce a higher dose to the gonads than dozens of other radiographic examinations. A single pediatric fluoroscopy can easily produce exceptional gonadal exposure. Routine X-ray pelvimetry may offset the radiation safety efforts of radiologists and general practitioners not engaged in obstetrics. It appears clear that serious consideration should be given to any and all measures which may discourage or prevent the particular exposures which are of overriding importance.

We should like to make some comments at this point on the problems of field studies devoted to the magnitude of X-ray exposure of large populations. Such a project was considered but not actually attempted in Oregon. Because of the great individual variations in technique, particularly in coning and local shielding, we believe that the only accurate way to estimate gonadal dose associated with a given exposure of a patient is to measure it, using a standard phantom in the office where the X-ray was actually taken.

If attempting such a study, we would proceed as follows, in the light of what we have learned.

An entire medium-size community would be

appraised in the manner of our survey, but in addition, direct-beam and scatter measurements would be made in each office for several representative views, such as X-rays of the chest, abdomen, hips, and knee, using the phantom. Special measurements would be taken with dental units, pediatric fluoroscopes, and chiropractic units used for spinograms.

After all units were examined in this way, a sample of the population would be chosen for a detailed anamnestic study of all sources of radiation exposure during the preceding year. With prior measurements on hand, it would then be possible to make a good guess as to gonadal exposures associated with a given X-ray taken on a given unit. The problem here is the probable and understandable reluctance of practitioners to allow measurements in regard to any specific patient. On the basis of field experience, the application of extensive tables designed to derive gonadal doses from stated exposure conditions is subject to serious errors due to inaccuracies and variations in kilovolt and milliamperage settings, and most particularly because of difficulties in defining the extent of coning. In actuality, the only practical way coning can be defined with any assurance is to study the radiation field itself, either with fluorescent screens or instruments. We do not believe it is practical to expect "cone cuts" on all films at the present time. Rather unexpected vagaries have been found even in some variable aperture collimators, for example, nonuniform fields in which the intensity falls off at different rates in different directions (14). The effects of local shielding, when used, would also be extremely difficult to predict accurately. Field measurements with a phantom would no doubt be subject to many errors also, but they appear the best hope for getting a more nearly accurate estimate of gonadal exposure.

Summary and Conclusions

1. The Oregon survey included approximately 25 percent of all users of diagnostic X-ray units in the State. Little geographic variation was found in regard to patient or personnel radiation exposures.

2. Radiologists and hospitals in which the

X-ray work is under the direction of radiologists had much higher scores than most other groups surveyed on a majority of the items pertinent to radiological protection.

3. Personnel exposure appears to be fairly well under control though film badges should be used much more widely for documentation of exposure.

4. Patient exposure can be reduced by a number of techniques, all of which should be considered. However, on the basis of the experience in Oregon, and considering practical field problems, we recommend that control measures be listed in the following order: (a) coning, (b) added filtration, (c) full-film processing, (d) fast film, (e) local shielding, (f) fast-intensifying screens, and (g) higher kilovoltage technique. In most instances, collimation should be combined with local shielding, which is essential to obtain gonadal protection in most abdominal and pelvic shots.

5. Existing data reveal that only a certain few X-ray examinations contribute most of the gonadal doses.

6. Because of the large radiation doses associated with such procedures as spinograms, well-baby fluoroscopy, and routine pelvimetry, such exposures should be curtailed.

7. Our experience suggests that the successful application of the cited techniques on a wide scale will reduce population gonadal exposure to one-half and perhaps to as little as one-fifth of present exposure. There is no question that this will be a long, complex effort requiring much educational activity as well as further improvements in the technical aspects of X-ray work.

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New Jersey's Action Program to Prevent Poliomyelitis

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NEW JERSEY experienced a relatively high incidence of paralytic poliomyelitis during 1958. There were 266 cases of illness and 10 deaths due to the infection reported to the State department of health (1). The number of paralytic cases increased more than six-fold, from 29 in 1957 to 186 in 1958. One hundred and nineteen of the paralytic cases were confirmed by laboratory isolation of poliomyelitis virus. Among those affected by paralytic poliomyelitis, 35 percent were under 5 years of age. Another 21 percent were 5 through 9 years of age. Less than 10 percent of all persons with paralytic disease had received three inoculations of Salk vaccine.

Planning

In January 1959 representatives of statewide medical, health, nursing, educational, and parent-teacher organizations met to consider means of achieving widespread poliomyelitis immunization among those groups who lacked the protection provided by poliomyelitis vaccine.

At the meeting it was reported that the Medical Society of New Jersey was considering a resolution urging all of its component county medical societies to encourage local boards of

education and other educational systems to require poliomyelitis immunization as a prerequisite for admission to school.

A number of representatives stated that there would be little purpose in stimulating demand for immunization unless facilities and vaccine were available to provide the immunizations.

Representatives of the National Foundation reported that when a public clinic is conducted, the general demand for immunization rises. The fact that children are being vaccinated in one situation influences many parents to seek poliomyelitis immunization for their children from family physicians.

Representatives at the meeting endorsed four proposals:

1. The Medical Society of New Jersey resolution encouraging poliomyelitis immunization as a prerequisite for admission to school.
2. Cooperative surveys to determine the status of poliomyelitis immunization, particularly in low socioeconomic groups.
3. Aggressive poliomyelitis immunization programs planned cooperatively by health departments, medical societies, and community agencies.
4. Expansion of existing local health department immunization programs in areas of medical indigency.

A second meeting was held in February 1959 to consider a plan to survey the poliomyelitis immunization status of persons in selected New Jersey communities. The proposed plan was designed to define local problems clearly so that positive action would be taken to immunize as many members of susceptible groups as possible

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prior to the 1959 poliomyelitis season. It stated that local health departments would be responsible for immunization programs in areas where studies revealed incomplete immunization associated with medical indigency, and that the State department of health would provide vaccine for the medically indigent within the limitations imposed on the department by law.

Surveys were suggested for Newark, Jersey City, Paterson, Elizabeth, Bayonne, Hoboken, Trenton, Camden, and Atlantic City because in these cities a significant proportion of the population fell in the low socioeconomic group. Several of the cities had a high incidence of paralytic poliomyelitis during 1958.

It was recommended that the need for and methods of survey be discussed with the representatives of the local medical societies and with the local health officials of the cities under consideration.

Completed Plan

In a subsequent meeting representatives of the State department of health and the Medical Society of New Jersey considered the survey procedures and agreed on the following actions:

- Local health departments in cooperation with appropriate county medical societies determine areas of incomplete immunization associated with low socioeconomic status and medical indigency.
- Local health departments establish and medical societies assist in staffing facilities for administering poliomyelitis immunization to nonimmunized persons up to 20 years of age.
- The services of the immunization facilities be limited solely to residents of those areas defined as medically indigent by the health department and the medical society.
- Persons living in the defined areas be persuaded to utilize immunization services through organized community effort.

Local Action

District State health officers met with local medical societies to discuss the background, planning, and technique of the poliomyelitis immunization survey. Immediate cooperation was assured by the county medical societies.

The surveys were then discussed with the

local health officers. Planning meetings were held in each community to determine a course of action. The methods and results which follow reflect the ingenuity, initiative, and ability of the health professions in New Jersey to tailor action to meet specific needs.

Newark

During the 1958 New Jersey epidemic Newark experienced an unusual incidence of 43 paralytic cases. The Newark Division of Health in cooperation with the State department of health and the Communicable Disease Center of the Public Health Service undertook to determine the extent to which selected persons living in Newark had been immunized against poliomyelitis. In a most unusual response during the outbreak in mid-August the nurses of the bureau of child health and the Visiting Nurse Association conducted in 1 week a survey covering more than 8,000 persons. At that time, approximately 30 percent of children between 5 and 14 years and 50 percent of children under 5 years of age had not received Salk vaccine.

An intensive campaign was initiated, reaching every area of the community, so that by the end of 1958 more than 50,000 inoculations had been given in public and parochial schools, at city "baby keep well stations," in the division of health clinics, and in adult clinics throughout the city.

Inspectors of the Newark Division of Health visited approximately 3,500 families in the latter part of 1958. They surveyed all persons under 19 years to determine how many had been inoculated and the number of injections they had received. Those with no protection or with an incomplete series of inoculations were urged to obtain immunization. They were referred to private physicians, clinics, or the city's division of health.

Early in January 1959 the Newark Board of Education adopted a resolution that every pupil newly enrolled after January 31 of that year be required to have received at least one inoculation against poliomyelitis as a prerequisite of attendance at school.

When the plan for survey was presented to the Newark Division of Health in the spring of 1959, Newark elected to use the method of the

preceding summer and fall. A door-to-door survey to reach more than 7,000 families totaling approximately 28,000 persons in 12 housing projects was proposed. Techniques were planned to record all persons who were still in need of immunization and to persuade them to attend scheduled immunization clinics.

Starting in April, personnel of the city's bureau of communicable disease control visited 4,815 families, 2,520 distributed among all socioeconomic levels of the city and 2,295 in low-income housing projects. As a result, a total of 7,692 persons through 18 years of age either had or obtained a complete series of Salk vaccine injections. In midsummer more than 2,000 persons in these families still had received no Salk vaccine.

From April, when the survey started, through December, 83,818 cc. of vaccine were administered in the concurrent immunization program of the Newark Division of Health.

Jersey City

An immunization survey, undertaken in Jersey City in 1958, revealed that approximately 50 percent of children in the age group 5 through 14 years had not received Salk vaccine. It further revealed a remarkably low level of poliomyelitis immunization in adults. During and following the 1958 epidemic, demand for poliomyelitis immunization increased so that by the end of 1958 more than 12,000 inoculations had been given in city child health conferences.

When city health officials were approached in 1959 concerning a new study of immunization in Jersey City, there was an immediate affirmative response. The health department decided to survey seven low-income and one middle-income housing projects.

In a survey of 2,860 persons, principally in low socioeconomic areas, it was found that only 32 percent had completed a series of Salk inoculations. Increased immunization activity resulted, and more than 11,000 inoculations were given through the middle of July 1959.

Elizabeth

In April 1959 the Elizabeth Health Department initiated action to determine the protection level against poliomyelitis and to pinpoint

those groups in the population which had not been reached. Representatives of the Union County Medical Society, Tuberculosis and Health League, National Foundation chapter, council of parents and teachers, and representatives of the public schools were concerned that surveys in other parts of the country had demonstrated there were many unvaccinated persons in lower socioeconomic groups. The survey committee selected for intensive study a definite geographic area containing approximately 45 percent of the city's population, including the low socioeconomic groups and the medically indigent. Selection was based on 1950 census tract information, a planning board report, and a communicable disease control spot map. It was decided the survey would be limited to a study of the poliomyelitis immunization records of the 12 public elementary and junior high schools, 10 parochial schools, and 6 "baby keep well stations" located in the selected area.

Study of school immunization records showed a direct correlation between the percentages of students with less than three injections and low-income areas. In high-income sections, with a total school enrollment of more than 4,300 students, 76 percent had received at least one injection. In the low-income sections, with enrollment of about 6,000 students, only 59 percent had received at least one inoculation. In view of these findings, it was readily agreed that an intensified vaccination program be established.

A group of approximately 100 volunteers contacted approximately 1,500 families whose members included approximately 2,200 children under the age of 5 years. The immunization campaign reached 1,681 children who received a series of two injections and 220 children who were given their third injection.

A total of 3,012 inoculations were given in the public schools and 1,096 inoculations in the parochial schools. Immunization records indicate that 83 percent of students in the parochial schools are now triply vaccinated (2).

Paterson

When a poliomyelitis immunization survey was proposed in Paterson, it was learned that

the Passaic County Medical Society, together with the Passaic County Chapter of the National Foundation, had initiated a county poliomyelitis vaccine committee in 1957. The committee comprised representatives of labor, industry, health, pharmacy, education, and the main religious groups. In the spring of 1959, recommendations of the Public Health Service that immunization programs throughout the United States be stepped up stimulated the committee to action.

When the State department of health suggested a census of the children who had not been immunized, the local director of the civil defense organization offered the services of his group to canvass the county. The canvass gathered information concerning poliomyelitis immunization and data for civil defense and disaster control. This technique provided a great stimulus stirring thousands of persons to action.

More than 20,000 poliomyelitis vaccine inoculations were given. Eighty percent were first or second doses because beginning inoculations were emphasized.

Cooperating in the campaign were more than 130 doctors who volunteered their services, the boards of health in 16 municipalities who assisted, and the county's hospitals where ap-

proximately one-fifth of the inoculations were given. The local civil defense organization, in assuming a new function, set a precedent in community preventive action.

Northern State Health District

The Northern State Health District, consisting of Hunterdon, Morris, Somerset, Sussex, and Warren Counties, undertook a survey of general immunization requirements in the school districts of the five counties and the poliomyelitis immunization status of children enrolling for school in September 1959.

This survey included 119 municipalities in an area that is predominantly rural but is spotted with growing urban and suburban areas. Although 115 municipalities required smallpox vaccination for admission, only 31 required one or more inoculations of poliomyelitis vaccine.

Ninety-seven percent of the 11,168 students scheduled to enter school in September had complied with the smallpox requirement in July. School records on poliomyelitis immunization were incomplete because it was not a prerequisite for admission to school. However, 5,142 children were recorded as meeting poliomyelitis immunization requirements. This accounts for 54 percent of the entering

Table 1. Percent of persons through 39 years of age, uninoculated or triply inoculated, by socioeconomic group, poliomyelitis immunization surveys of selected New Jersey cities, 1959

City	Socioeconomic groups ¹											
	Total			Upper			Middle			Lower		
	Total number	Uninoculated	Three inoculations	Total number	Uninoculated	Three inoculations	Total number	Uninoculated	Three inoculations	Total number	Uninoculated	Three inoculations
Total	7, 279	45. 0	36. 3	524	20. 0	67. 0	3, 976	43. 4	37. 5	2, 779	52. 5	26. 0
Atlantic City	451	28. 3	62. 7	67	12. 0	77. 6	295	28. 1	62. 0	89	43. 8	53. 9
Bayonne	684	48. 4	30. 2	13	54. 0	23. 1	358	47. 2	34. 2	313	49. 6	25. 9
Camden	3, 804	49. 5	28. 6	77	37. 7	53. 4	2, 228	47. 2	31. 2	1, 499	53. 5	23. 4
Hoboken	589	35. 0	37. 0	63	28. 6	55. 5	222	25. 1	51. 7	304	55. 0	22. 4
Trenton	1, 751	40. 2	43. 0	304	13. 8	72. 0	873	42. 0	43. 0	574	52. 0	29. 7

¹ Households were assigned to a socioeconomic group on the basis of number of persons per room and the educational level of the head of the household. Households were scored as follows: 2 points for 0.74 persons per room, 1 for 0.75-1.24, and 0 for 1.25 or more; 2 points for 1 year of college or more or other formal training after high school, 1 for 7-12 grades, and 0 for 6 grades or less. A combined score of 4 points equaled the upper group, 3 or 2 points, middle group, and 1 or 0, the lower group.

first grade students, and is probably lower than the actual number.

Other Cities

Sampling surveys were undertaken in Hoboken, Bayonne, Trenton, Camden, and Atlantic City. While the organizations conducting the surveys varied, nevertheless there was a relative uniformity in technique. In each area, persons familiar with the local characteristics assisted in the definition of areas of high, middle, and low socioeconomic status.

The Hoboken Health Department nursing staff planned and conducted the survey under the guidance of the health officer and personnel of the State department of health.

In Camden, city health department nurses and other personnel of the department carried out the survey.

In Bayonne, the Visiting Nurse Association, under the guidance of its nursing director, sampled the community's immunization status.

In Trenton, a citizens' health committee fostered the survey and subsequent immunization campaign.

Finally, in Atlantic City volunteers of the National Foundation made the survey possible.

The results of sampling surveys in selected cities are presented in table 1. Information was obtained on a total of 7,279 persons. The sample is heavily weighted by persons in the middle and lower socioeconomic groups. Only 524 persons were sampled in the upper socioeconomic group. In the entire sample, approximately 43 percent of persons in the middle

socioeconomic group and 53 percent of persons in the lower socioeconomic group have had no Salk vaccine. Approximately 37 percent of the middle group and 26 percent of the lower socioeconomic group had completed the basic series of three inoculations.

Table 2 indicates the percentage of persons in the samples having three inoculations by age group, in the selected cities and Jersey City. This table is biased in the direction of the middle and low socioeconomic groups.

Generally, approximately 50 percent of the population sampled in the 5-14 age group has been completely protected. Only 28 percent of children under 5 years and 20 percent of persons between the ages of 15 and 39 have been completely protected. The highest levels of complete protection were found in Atlantic City and Trenton in the 5 to 14 age group.

While these figures are selective and contain bias, nevertheless, they serve to reveal quite dramatically conditions existing in the spring of 1959 in New Jersey. They highlight the continuing need for complete protection in the 5 to 14 age group and emphasize the need for starting and completing the series of inoculations for children under 5 years.

Effects of Surveys

Conducting the surveys, the survey findings, newspaper publicity, the activity of professional organizations, visiting of homes, and the neighborhood impact served to stimulate widespread immunization. Cities surrounding major sampling areas undertook surveys of their own (3,4). This multiplying effect was antici-

Table 2. Percent of persons triply inoculated, poliomyelitis immunization surveys of selected New Jersey cities, 1959

Age group (years)	All cities			Atlantic City	Bayonne	Camden	Hoboken	Jersey City	Trenton
	Number surveyed	Number with three inocula- tions	Percent with three inocula- tions						
Total	10, 139	3, 464	34. 2	62. 7	30. 2	28. 6	37. 0	32. 0	43. 0
Under 5	2, 809	799	28. 4	48. 1	31. 0	28. 3	20. 6	21. 4	39. 6
5-14	3, 862	1, 975	51. 1	85. 7	60. 0	49. 0	66. 5	40. 0	71. 7
15-39	3, 468	690	19. 9	49. 0	16. 7	13. 9	27. 0	18. 9	25. 7

pated and contributed to wider immunization than could be expected from the individual surveys.

Use of Salk Vaccine

Two gauges may be used to measure the use of Salk vaccine within the State, the records of shipments from manufacturers to commercial and public agencies and the records of the State department of health biological distributing stations.

Between January 1 and December 25, 1959, a total of 1,785,000 cc. were shipped to the State, 1,113,000 cc. to commercial outlets and 672,000 cc. to public agencies. Vaccine was in short supply during July and August.

Records of the biological distributing stations indicate that the total of 555,760 cc. issued in 1959 exceeds by 180,000 cc. issues made in 1958. At the height of survey activity in May and June 1959 nearly 200,000 cc. were issued.

Future Activity

The results of the surveys conducted in the spring of 1959 indicate need for continuing programs to improve the poliomyelitis immunization status of the population.

Two types of activity are planned: a broad survey of immunization status of pupils to be carried out by boards of education, and surveys by boards of health of the immunization status of children through 2 years of age.

The school survey is designed to determine if school districts and parochial schools require poliomyelitis immunization. Selected schools will then be sampled to determine the completeness of the students' poliomyelitis immunization. These studies are to be followed by activities designed to stimulate immunization of all students who are incompletely protected.

The studies by boards of health are proposed to determine the immunization status of the younger children. This will provide an opportunity to explain the need for complete immunization to parents.

Summary

In 1958 New Jersey experienced an outbreak of poliomyelitis in which 90 percent of persons with paralytic disease had not received Salk vaccine. Preliminary surveys in 1958 indicated that a substantial portion of the population of several cities had not received three inoculations of Salk vaccine.

A survey and immunization plan was developed for cooperative action by the health departments, medical societies, and voluntary agencies. Surveys were carried out in one State health district, one county, and nine large cities of the State. Several methodologies were used with equally good effects.

A direct relationship was found between the degree of immunization and socioeconomic status. The higher the socioeconomic status, the more nearly complete the immunization. A need for starting and completing immunization of large numbers of persons through 18 years of age was revealed.

Surveys were followed by increased numbers of immunization programs and broader coverage of persons, and more vaccine was used throughout the State.

Future action includes immunization surveys by boards of education and boards of health and increased immunization activity.

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Group Attitudes and Information Sources in a Poliovaccine Program

FRANCIS A. J. IANNI, Ph.D., ROBERT M. ALBRECHT, M.D., M.P.H., and ADELE K. POLAN, M.A.

MUCH recent attention has been focused on public acceptance of the Salk poliomyelitis vaccine program (1-6). Part of this interest is the result of the unique nature of the program itself—a major experiment involving the people of an entire Nation as both subjects and interested observers. The confusion and controversy which marked several stages of the program have also added interest. But a large measure of its public health importance results from its value in planning other health programs. If modern medical science can provide the requisites for disease control, and if health administrators design mass programs, then the remaining variable of public opinion and acceptance is all that stands in the way of success. We may learn from the Salk vaccine experience which segments of the population were not reached and why and, most important for the future, how they may be reached.

In implementing health improvement programs, the health officer generally takes for granted that varying degrees of support will be found among the public health population and that there are "unreachable" segments.

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Usually there is no attempt to reach specific groups; a mass approach is used in the hope of reaching as many people as possible. Various media of communication are used to disseminate information about the value of particular health measures, and it is fondly hoped that the result of such an educational effort will be general acceptance. If, however, it is known in advance which segments of the population are most resistant, and which media of information is the most successful in reaching them, a more comprehensive and direct approach would be possible.

This paper presents data concerning the relative importance of various media of communications in the formation of attitudes regarding vaccination for poliomyelitis among various social groups in two counties in New York. The data are drawn from a larger home interview study of two New York State counties in the spring and summer of 1957. A previous paper presented the findings of parts of the study dealing with vaccination levels by age, sex, social class, and education (7).

The Study Design

The methodology for the study, described in the earlier paper, was based on the home interviews in area probability samples in each of two counties. These were Rensselaer County, semirural, with one large and one small city, and Westchester, urban and suburban, adjoining New York City.

A random sample of subareas designed to yield 1,000 households was selected in each

Table 1. Sources of information on poliomyelitis vaccine of persons classified by social position scores, Rensselaer County, N.Y.

Social position class ¹	Source of information									
	Newspaper		Television		Physician		Radio		School	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Total	710	76.3	595	64.0	349	37.5	560	60.2	303	32.6
I	36	81.8	23	52.3	30	68.2	25	56.8	23	52.3
II	45	86.5	38	73.1	18	34.6	33	63.5	19	36.5
III	166	81.8	144	70.9	100	49.3	135	66.5	78	38.4
IV	255	78.0	206	63.0	125	38.2	194	59.3	108	33.0
V	159	69.7	157	68.9	71	31.1	139	31.0	71	31.1
Unscored	49	64.5	27	35.5	5	6.6	34	44.7	4	5.3

¹ According to the Hollingshead two-factor index of social position.

county, and interviewing began in April 1957 and continued through May of that year. The schedule of questions aimed at obtaining information on the poliomyelitis vaccination history of each member of the household, sociocultural characteristics, opinions as to why individual members of the household and certain other population groups had or had not been vaccinated, and the effects of various media of communication on the decision regarding vaccination.

In all, 930 households representing 3,095 persons were interviewed in Rensselaer County and 904 households with a total of 3,305 persons, in Westchester. Following the interviews, in a comparison of known demographic characteristics of the sample population with those of

the general population, we found a close similarity in household size, sex distribution, and age and educational structure.

Findings

Different population groups are differentially exposed to informational media. The recent summary of research sources of information on the vaccine program made by Rosenstock and his associates concludes further that the majority of these studies indicate that they will have to be reached through personal contact rather than through the mass media (6). While not negating the value of the mass media in such a program, the summary article does give the impression that the hard-to-reach groups are

Table 2. Sources of information on poliomyelitis vaccine of persons classified by social position scores, Westchester County, N.Y.

Social position class ¹	Source of information									
	Newspaper		Television		Physician		Radio		School	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Total	651	72.0	563	62.3	406	44.9	353	39.0	239	26.4
I	109	82.6	111	84.1	78	59.1	58	43.9	38	28.8
II	103	81.7	110	87.3	60	47.6	50	39.7	48	38.1
III	204	78.8	200	77.2	139	53.7	108	41.7	75	29.0
IV	154	68.1	104	46.0	91	40.3	93	41.2	53	23.5
V	52	46.8	38	34.2	29	26.1	26	23.4	19	17.1
Unscored	29	58.0	0	0.0	9	18.0	18	36.0	6	12.0

¹ According to the Hollingshead two-factor index of social position.

Table 1. Sources of information on poliomyelitis vaccine of persons classified by social position scores, Rensselaer County, N.Y.—Continued

Social position class ¹	Source of information						Total number
	Magazine		Health department		Pamphlet		
	Number	Percent	Number	Percent	Number	Percent	
Total.....	249	26. 8	254	27. 3	87	9. 4	930
I.....	21	47. 7	16	36. 4	8	18. 2	44
II.....	18	34. 6	18	34. 6	5	9. 6	52
III.....	57	28. 1	73	36. 0	34	16. 7	203
IV.....	84	25. 7	82	25. 1	20	6. 1	327
V.....	60	26. 3	56	24. 6	14	6. 1	228
Unscored.....	9	11. 8	9	11. 8	6	7. 9	76

¹ According to the Hollingshead two-factor index of social position.

best reached through some sort of personal contact. Our data, however, do not support this contention, particularly in the more rural county of Rensselaer.

As part of the schedule of questions, each respondent was asked if he or she had received any information concerning the poliomyelitis vaccine program from certain specified sources of information which included both mass media of communication and personal contacts. Personal contact sources, such as husbands, wives, and friends, appeared to be the least frequent sources of information. In Rensselaer County, for example, only 20.2 percent of all respondents reported information of any degree of importance from husbands, 5.9 percent from wives, 21.8 percent from children, 29.2 percent

from friends and neighbors, 8.0 percent from other household members, and 4.1 percent from other persons. Similarly, in Westchester County 14.4 percent reported information from husbands, 3.4 percent from wives, 10.4 percent from children, 28.5 percent from friends and neighbors, 2.6 percent from other household members, and 1.2 percent from other persons.

One source of personal approach reported very frequently was the physician: 37.5 percent of the respondents in Rensselaer County and 44.9 percent of the respondents in Westchester County reported having received information from this source (tables 1 and 2). Since it seems to be specifically the lower economic and social classes who need to be reached we were interested in finding out the general

Table 2. Sources of information on poliomyelitis vaccine of persons classified by social position scores, Westchester County, N.Y.—Continued

Social position class ¹	Source of information						Total number
	Magazine		Health department		Pamphlet		
	Number	Percent	Number	Percent	Number	Percent	
Total	217	24. 0	94	10. 4	50	5. 5	904
I	44	33. 3	14	10. 6	11	8. 3	132
II	31	24. 6	10	7. 9	7	5. 6	126
III	64	24. 7	22	8. 5	13	5. 0	259
IV	60	26. 5	34	15. 0	12	5. 3	226
V	14	12. 6	10	9. 0	5	4. 5	111
Unscored	4	8. 0	4	8. 0	2	4. 0	50

¹ According to the Hollingshead two-factor index of social position.

social class distribution of the respondents who reported information from physicians.

The respondents had been previously classified in socioeconomic and educational status groups by use of the Hollingshead two-factor index of social position, a scale using occupation and education weighted individually and then combined to give an "index of social position score" (8). Each member of a household was assigned to one of five social position classes, based upon the index score of the chief wage earner of the household. The social class position of the respondents who reported information of some degree of importance from physicians is presented as part of tables 1 and 2.

As these tables indicate, the higher social position classes more frequently report physicians as sources of information. The percentage of respondents reporting information from physicians in Rensselaer County as a whole is significantly lower than in Westchester County, which has a generally higher socioeconomic grouping. This suggests that the only source of personal approach at all effective in reaching the population in the poliomyelitis vaccine program is the physician, and that even here the amount of information received was not nearly so great among the lower socioeconomic and educational groups who are the "hard-to-reach" segments of the population for whom the personal approach is recommended.

Our data also reveal the continuing efficacy of the conventional mass media of communication in reaching, if not persuading, members of all classes. Communications research has indicated that lower social groups tend to read newspapers, and also to read items of educational, scientific, and health affairs within newspapers, less frequently than the higher groups (9). Our data support this conclusion, and in both counties, newspapers as sources of information decrease with social class position (tables 1 and 2). But even in the lowest social class the newspaper is still the most frequently cited medium of information. Almost 70 percent of the respondents in Rensselaer and 47 percent in Westchester in this class named this source.

Television, the second most frequently cited information medium, decreases in importance steadily and significantly as social class posi-

tion decreases in urban Westchester County. The percentage of class V respondents naming this source was less than half of that in class I. In rural Rensselaer County, however, no decrease is shown.

Again, our data seem to confirm the finding of earlier studies of communications that social classes differ little in exposure to radio. There is little difference from class to class in either county except in the lowest class in Westchester County, which cites this source relatively seldom. The lowest class in Rensselaer reports radio as a source about as often as the other classes and, indeed, more frequently than class I. The most interesting fact relating to radio is the much higher percentage reporting this source in Rensselaer County (60.2 percent) than in Westchester County (39.0 percent).

As might be expected, the magazine as an information medium is much more common in the upper social class groups. The percentage of respondents in Rensselaer who reported information from the health department was almost three times as great as in Westchester, and a higher proportion also cited a school as a source.

Our data indicate that in the two counties pamphlets, such as those distributed by the National Foundation, were a negligible factor, having been most frequently cited by the higher social position classes which already had a high rate of exposure to other sources.

All of these data throw some light on the comparative value of the mass media and "personal" contact in the vaccine program. First, with the exception of the physician, personal contact played little or no role in disseminating information about the program. It might be argued that while personal contact was not extensive as a source, it was more effective than the mass media approach where it did take place. In a separate question we asked our respondents what was the most important source of information figuring in decisions to be vaccinated. Once again the mass media were much more commonly listed. As a matter of fact, the newspaper was listed more frequently than the physician in both counties, and in Rensselaer County, television was listed as often as the physician. Certainly physicians as health authorities are important in

Table 3. Opinions as to whether the Government should provide free vaccine to children, expressed by respondents in Rensselaer County, N.Y., classified by social position score

Social position class ¹	Total number	Government should		Government should in need only		Government should not		Undecided and no opinion	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent
Total.....	930	750	80.6	112	12.0	16	1.7	52	5.6
I.....	44	31	70.5	7	15.9	3	6.8	3	6.8
II.....	52	41	78.8	7	13.5	3	5.8	1	1.9
III.....	203	174	85.7	18	8.9	2	1.0	9	4.4
IV.....	327	267	81.7	37	11.3	5	1.5	18	5.5
V.....	228	184	80.7	31	13.6	1	.4	12	5.3
Unknown.....	76	53	69.7	12	15.8	2	2.6	9	11.8

¹ According to the Hollingshead two-factor index of social position.

producing a favorable decision toward vaccination, but once again it is the "hard-to-reach" lower class groups who least commonly come in contact with physicians, and they must receive information in order to make a favorable decision.

A second important finding is that with the possible exception of radio and, to a lesser extent, television, the mass media are more commonly cited as sources of information with increase in social class position. The mass media appear by far the most common and reliable means of reaching the largest proportion of all social classes.

Finally, and perhaps most important of all, it appears that the mass media of communication are more commonly cited, particularly in

the "hard-to-reach" lower classes in the semi-rural county of Rensselaer than in the more urban Westchester. Newspaper, television, and radio information reached a significantly higher proportion of the lowest two classes in Rensselaer than was reported in Westchester. This is also true when the samples are considered as totalities. In each case, the upstate, largely rural respondents from Rensselaer reported information from newspapers, television, radio, and even magazines more frequently than did the more urbanized Westchesterites.

In assessing the relative value of various media of communication, then, it might be hypothesized that in rural areas, where contact with physicians is less frequent and where the lower population density places greater re-

Table 4. Opinions as to whether the Government should provide free vaccine to children, expressed by respondents in Westchester County, N.Y., classified by social position score

Social position class ¹	Total number	Government should		Government should in need only		Government should not		Undecided and no opinion	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent
Total.....	904	589	65.2	178	19.7	72	8.0	65	7.2
I.....	132	74	56.1	34	25.8	15	11.4	9	6.8
II.....	126	72	57.1	26	20.6	18	14.3	10	7.9
III.....	259	162	62.5	49	18.9	22	8.5	26	10.0
IV.....	226	170	75.2	38	16.8	9	4.0	9	4.0
V.....	111	79	71.2	22	19.8	2	1.8	8	7.2
Unknown.....	50	32	64.0	9	18.0	6	12.0	3	6.0

¹ According to the Hollingshead two-factor index of social position.

liance on the mass media for information, the traditional sources of information are still the most valuable. In promoting health education, then, it is most important to know the cultural milieu of the area.

An earlier article describing some of the attitudes expressed by respondents on such questions as why people have or have not been vaccinated, shows important differences between our two dissimilar counties. Some additional data we have processed by social class position again indicate differences among both social classes and rural-urban locality. One of the questions we asked was whether the respondent felt that the Government should or should not provide free vaccine for school-age children. As we expected, the lower middle groups expressed the highest degree of favor toward free vaccine (tables 3 and 4). We had expected, however, that the more urban Westchesterites would express the more "liberal" attitudes toward Government aid while the conservative country dwellers would oppose it. Just the opposite was true. While it was still very small, the proportion of respondents in Westchester County opposing Government-supplied vaccine was four times as great as in Rensselaer. This is even more surprising in view of the fact that the proportion of people vaccinated was higher in Westchester than in Rensselaer. There are many possible explanations for this, including need or political orientation, but it does indicate that regional and rural-urban factors do have a bearing in the formation of attitudes concerning vaccination.

Discussion

At first glance, our findings appear to be at variance with the growing belief that personal contact best reaches the lower income family with little formal education. Our data indicate that the mass media are still the most effective means of reaching the public. We agree, however, that personal contact, particularly with a physician or other health figure, is probably the most effective means of persuading individuals to be vaccinated once they have been reached. While Rensselaer County had a higher rate of reported information from mass media, it was lower than Westchester in

reported information from physicians and had a lower rate of vaccination in all social classes. The problem of the vaccine program would seem to be one of motivation rather than of sheer exposure to media.

Exposure to information sources was high in all social classes. But exposure is not enough. The individual's decision as to whether or not to be vaccinated is related to such factors as health attitudes and attitudes toward science. The remaining factor is motivation, for the individual must be convinced that vaccination is a step important enough to overcome the many adverse factors tending to hold him back from seeking vaccination. Getting the information to him is merely an avenue of approach, the important problem is how to convince him—once we have gotten to him—that he should be vaccinated. We agree that personal contacts would probably be the most effective means but even this presents problems. First, we must ask: "personal contact with whom?" The most common contacts are with family, relatives, neighbors, and work associates, and our data suggest that they are poor sources of information. Even if they were excellent sources there is the question of level of information. Each "layman" who becomes a source of information must be educated as to the benefits of vaccination from some previous source. The answer would seem to rest with the private physician in his contact with patients, but the individuals who are most resistant to vaccination are the ones least likely to come in contact with physicians.

The traditional means of communication and dissemination of information still appear to us to be the best methods of getting the information to the public. If our data are indicative of conditions in other areas, particularly rural and semirural, mass media do reach the public, even the lower classes. What is necessary is a new approach in motivating people to seek vaccination; an approach which can be adapted to the existing means of communication.

Summary and Conclusions

After assigning respondents from an area probability sample in two New York State counties into Hollingshead social position

classes, we have attempted to express the differences in reported exposure to various media transmitting information on the Salk vaccine program among these classes and between the two dissimilar counties. We found that personal contact media were least reported, with the exception of the physician, and citing the physician was most common in the upper social class groupings. The mass media of communication—newspapers, television, radio, and to a lesser extent magazines—were the most commonly reported. These media tended to be more often reported as social class position increased. The mass media were much more often reported as sources in Rensselaer County than in Westchester County, particularly in the lowest social class.

We believe that the findings indicate that the mass media reach the public, even the lower social classes, and are still the best way of getting information to the public. What is needed is a new approach, adaptable to these media, toward motivating individuals to seek vaccination.

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Laboratory Refresher Training Courses

Refresher training in laboratory methods will be offered at the Communicable Disease Center, Public Health Service, Atlanta, Ga., during the period October 10, 1960, through April 7, 1961, as listed below. Information and application forms can be obtained from the Laboratory Branch, Communicable Disease Center, Public Health Service, Atlanta, Ga.

Fundamentals of virology (819). Oct. 10-21.
 Diagnosis of tuberculosis (855). Oct. 31-Nov. 11; Jan. 30-Feb. 10.
 Diagnosis of rabies (826). Nov. 28-Dec. 2; Apr. 3-7.
 Bacteriophage typing of staphylococci (856). Dec. 5-9.
 Medical mycology (815). Jan. 9-Feb. 3.
 Serologic methods in microbiology (941). Jan. 23-Feb. 10.
 Study of pulmonary mycoses (817). Feb. 13-24.
 Medical bacteriology (838). Feb. 27-Mar. 17.
 Veterinary mycology (940). Mar. 6-10.
 Diagnosis of viral and rickettsial diseases (820). Mar. 13-31.

Special problems in medical bacteriology (839). Mar. 20-24.
 Enteric bacteriology (850). Mar. 27-Apr. 7.
 Courses in the following will be offered by special arrangement only:
 Laboratory methods in the diagnosis of malaria (805).
 Special training in virus techniques (821).
 Typing of *Corynebacterium diphtheriae* (842).
 Special problems in enteric bacteriology (851).
 Phage typing of *Salmonella typhosa* (852).
 Laboratory methods in the diagnosis of leptospirosis (853).
 Serologic differentiation of streptococci (854).
 Special problems in microbiology (942).

approach to ZERO *for Tuberculosis*

ADDENDUM

H. S. WILLIS, M.D.

A challenge to people in the health professions was voiced in the issue of *Public Health Reports* for February 1960 which carried the gist of the recent Arden House Conference on Tuberculosis. The official report of the conference and the summarizing statement presented well-thought-out material, worthy of full and active endorsement. This is a good report—a document which points to the gains to date against tuberculosis and the weaknesses in the present attack. It suggests ways and means toward elimination, if not eradication, of tuberculosis in this country. It properly stresses the public health features of the disease and points to the importance of protecting the community.

The recommendations which grew out of this conference aim at identifying "some of the deficiencies of current tuberculosis control programs." Hospital treatment is not thought of as a deficiency, hence the lack of emphasis by the conference on this aspect of the attack. The importance of hospitalization, however, appears fully to justify further emphasis at this time and in this connection when attention is being focused on an all-out attack against the disease.

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What is now to be said about this report is not in criticism of it for every comment in it is reasonable and every recommendation a sound one which must be put into effect if we are to rout this disease from our midst. But the one factor in the armamentarium against the disease, as referred to above, received rather incidental mention for the reason given. The official report says "infection can be prevented by eliminating active disease," but it refers seldom to isolation as an instrument of control. Isolation is at the heart of home treatment which stands high in its recommendations.

Homes of the well-to-do will readily provide satisfactory arrangements for isolation, sanitation, ventilation, medical care, and dietary needs. Patients treated in such homes do well. But this is not true for the average home, where tuberculosis is discovered most often. As shown in the report, tuberculosis is distributed in a spotty way throughout the country. More often than not excessive tuberculosis coexists in homes with low economic, low educational, and, frequently, high emotional levels. Tuberculosis spreads and prospers where there are overcrowding, underfeeding, and the strains and stresses that are a part of poverty. An adequate setup for full use of the tools of both prevention and therapy is seldom

found in the impoverished home. Under these conditions, how many homes could create and sustain adequate treatment? In my State, which still has tinges of tuberculosis and poverty, it appears that not more than 10 per cent would qualify.

To hold a patient with active disease in an inadequate home for the weeks and, occasionally, months of treatment required to produce negative status, in a home where bacilli and numerous members of the family have close association, is an open invitation to the breeding of new cases and certainly is to seed infection to an unknown number of contacts. Most physicians hold that it requires more than the tubercle bacillus to produce clinical tuberculosis. None, however, would deny that this micro-organism stands in a *sine qua non* relationship—that we would have no tuberculosis without the tubercle bacillus. Preventing spread of infection wherever possible is therefore incumbent upon us.

The Arden House Conference came into being through joint sponsorship of the Public Health Service and the National Tuberculosis Association. At its February 1960 meeting the board of directors of the National Tuberculosis Association deliberated on and fully endorsed the recommendations presented by the conference and has included a reference to hospitalization as an acknowledged instrument of tuberculosis control. Action of this body is as follows (1):

The board of directors endorsed the principal recommendation of the Arden House Conference and the 11 subsequent recommendations. Furthermore, the board directed that:

1. The National Tuberculosis Association exert a maximum effort over the next few years to implement the major recommendation of the Arden House Conference in close collaboration with the U.S. Public Health Service.

2. The National Tuberculosis Association work in cooperation with the Public Health Service to achieve the goals suggested by the other 11 recommendations.

3. Constituent and affiliated tuberculosis associations be urged to take leadership in their areas to implement the Arden House Conference recommendations.

4. The National Tuberculosis Association staff be asked to report to the board of directors 1 year from now on the progress made to implement the major recommendation and the other 11 recommendations.

The Arden House Conference confined its recommendations to certain selected deficiencies of current tuberculosis programs requiring special new emphasis. To avoid any possible misinterpretation that hospital treatment is no longer desirable, the board of directors passed the following additional statement:

Initial hospitalization of all persons with communicable tuberculosis is desired. Continuing hospitalization is desired for all tuberculosis patients where home conditions are not adequate or sanitary. Such hospitalization should not be terminated until after negative status has been achieved.

This note is expression of a wish that this otherwise forward-looking challenge might have mentioned hospitalization not inferentially (though favorably) but had advocated it boldly where needed and had done so as if it were a vital part of the "big push ahead." It is proper to assume that hospitalization is used to a greater or lesser extent by most people concerned with treatment of the tuberculous as a satisfactory public health measure against spread of infection even if not primarily for therapy, but mention in the report of its positive value would have contributed an added thrust to this otherwise helpful document. Continued ignoring of such a mode of treatment could possibly destroy the idea of hospitalization altogether which certainly was not implied in the report and surely not desired by members of the conference.

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STATEMENT

By Arthur S. Flemming, Secretary of Health,
Education, and Welfare, April 28, 1960

Strontium 90 Content of Wheat

The regular quarterly statement on fallout of the Atomic Energy Commission, released April 28, 1960, contains data relating to the strontium 90 content of wheat and wheat products from the 1958 crop in Minnesota, North Dakota, Montana, Illinois, Kansas, Oklahoma, Texas, Michigan, and New York. These data are summarized below:

Material	Strontium 90 ($\mu\text{c./kg.}$)		
	Low	High	Average
Wheat -----	21	133	62
Patent flour-----	3	42	12
1 and 2 clear flour-----	6	86	28
Germ -----	50	191	
Shorts -----	28	665	
Bran -----	52	675	231

NOTE: A curie is a measure of radioactivity equivalent to that produced by 1 gram of radium. A microcurie ($\mu\text{c.}$) is 1 millionth of a millionth of a curie.

The statement of the Atomic Energy Commission also shows that up to the present time analyses on the 1959 crop have been completed for whole wheat only. These analyses show results similar to those for the 1958 crop.

At my request, the Public Health Service, the Food and Drug Administration, and the Federal Radiation Council have reviewed these data. They have advised me that the strontium 90 intake of the U.S. population from all dietary sources does not constitute a public health hazard warranting any regulatory action at the present time.

The conclusion that the present situation does not call for any regulatory action was based on the following considerations:

The guideline for average daily intake of strontium 90 used by this Department at present is 33 micromicrocuries per liter or kilogram of total dietary intake averaged over a period of

1 year. This value is derived from the recent interim recommendation of the National Committee on Radiation Protection and Measurements that the values suggested by the International Commission on Radiation Protection for planning purposes be accepted. Although this guideline was not developed to serve as a limit for regulatory purposes, it is a conservative basis for evaluating the significance of these data. For general populations the International Commission on Radiation Protection suggested 33 micromicrocuries per liter or kilogram based upon a 50-year exposure, but for operating purposes averaged over periods not to exceed 1 year. This value applies to all groups within the population. In considering the health effects of strontium 90 it is necessary to take into account the amounts ingested from all sources. The average weight of food and water ingested per day per individual in the United States is 2.2 kilograms. If all food and water contained this concentration of 33 micromicrocuries per kilogram the daily intake of strontium 90 would be 73 micromicrocuries (2.2×33).

The following diet shows how the wheat data reported by the Atomic Energy Commission would be reflected in a typical adult diet of 2,200 grams per day. (A gram is $\frac{1}{1,000}$ of a kilogram or $\frac{1}{28.35}$ of an ounce.) This diet is adapted from one that was presented by the Public Health Service at hearings of the Joint Committee on Atomic Energy last year. An estimated average daily consumption of 1.8 grams of bran, as estimated by the U.S. Department of Agriculture, was added to this diet (rounded in the table to 2.0 grams). The strontium 90 values for bran and flour products in this diet are the average values of the Atomic

Energy Commission report. The strontium 90 values for other items of this diet are considered typical for a large metropolitan area.

Diet item	Strontium 90 content in micro- microcuries per gram	Food con- sumption in grams per day	Strontium 90 in micro- microcuries per day
Bran -----	0.231	2	0.4
Flour products -----	.012	227	2.7
Foods other than milk, water, and wheat products -----	.004	971	3.9
Milk and milk prod- ucts -----	.010	410	4.1
Water and other non- milk fluids -----	.001	590	1.0
Total -----		2,200	12.1

The averages were used in the above table because the National Committee on Radiation Protection and the International Commission on Radiation Protection recommendations are for general population averages. It is, however, necessary to consider individual variations from the average involving the known deviations in concentrations of strontium 90 from the average and individual variations in dietary habits. In calculating the guidelines for specific averages, the National Committee on Radiation Protection and the International Commission on Radiation Protection recommendations allow departures as much as three times such averages. In a given case this could be equivalent to an individual lifetime average of 220 micromicrocuries of strontium 90 per day.

I have had my staff calculate the strontium 90 content of various probable diets under the varying concentrations of strontium 90 reported by the Atomic Energy Commission. The conclusion was that it would be highly improbable that any individual could attain an average of 73 micromicrocuries of strontium 90 per day for life, let alone the higher figure of 220 micromicrocuries.

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Available evidence indicates that in 1958 the major fraction of strontium 90 found in wheat was directly absorbed through the outer layer of the kernel, this coming from atmospheric deposition. Some is absorbed through other parts of the plant. The relative contribution of strontium 90 from various parts of the plant is dependent upon the existing conditions, such as atmospheric deposition, accumulation in the soil, and the weather. Studies reveal, however, that of the amount of strontium 90 absorbed by the leaves of the plant only very little is transported to other parts of the plant.

The strontium 90 in bran used for livestock feed is not posing a problem at this time. The total diet of livestock includes bonemeal and inorganic minerals as the principal sources of calcium. Research with the dairy animal has established the fact that milk contains about one-tenth of the amount of strontium 90 that is consumed in the feed. Since strontium 90 is deposited in the bones, it does not provide a problem in the meat of the beef animal.

Arthur P. Miller Retires

Arthur P. Miller, a sanitary engineer with the Public Health Service for nearly 40 years, retired on May 31.

During most of his career, Mr. Miller was stationed at headquarters in Washington, D.C., with responsibilities for water, vessel, and shellfish sanitation investigations, and surveys of sanitary engineering education.

Mr. Miller is author or co-author of about 100 publications in the engineering field. He is a member of the American Public Health Association and has served on its governing council and its editorial board. He has served as chairman of the publications committee of the Federation of Sewage Works Federations and as acting executive editor of *Public Health Reports*.

Federal Publications

First Things and Last. The story of birth and death certificates. *PHS Publication No. 724; 1960; 24 pages; 15 cents.*

A pamphlet that tells what birth and death certificates are used for; who fills them out; and the route they travel from hospital, physician, and funeral director to the health department and permanent filing.

It is designed to inform persons who are involved in registration of birth and death certificates but who are not a direct part of the system.

Cerebral Palsy. Hope through research. *PHS Publication No. 713 (Health Information Series No. 95); 1960; leaflet; 5 cents, \$3 per 100.* Explains some known causes and discusses possible prevention of cerebral palsy. Describes main types and extent of condition, mentions common handicaps, and reviews helpful treatment. Gives sources of medical aid and stresses importance of research.

Highlights of Progress in Research on Neurological and Sensory Disorders, 1959. *PHS Publication No. 741; 1960; 60 pages; 25 cents.*

Items of interest on program developments and research studies conducted and supported during 1959 by the National Institute of Neurological Diseases and Blindness are presented. Subject areas include: nerve regeneration, the central nervous system, brain and cerebral cortex, infant abnormalities, neuromuscular disorders, parkinsonism, multiple sclerosis, amyotrophic lateral sclerosis, encephalitis, epilepsy, mental retardation, cerebral palsy, cerebrovascular diseases, and visual and hearing disorders.

Grants and training programs of several kinds are discussed as well as such collaborative projects as a 5-year study for early detection of glaucoma and the study on wastage in human pregnancy. In general, the institute's national and international attack on neurological and sensory disorders is outlined.

National Institutes of Health. *PHS Publication No. 81; revised 1960; 28 pages; 25 cents.*

This brochure is designed to give an overview of participation and support of the Nation's medical research program by the Federal Government through the National Institutes of Health, Public Health Service.

Pictures and text describe the organization and functions of the seven institutes and four divisions that make up the agency. Research studies are also discussed.

A brief history of NIH is included as well as a statement of present emphasis and philosophy.

An Occupational Health Program for Hospital Employees. *PHS Publication No. 725; 1959; 11 pages.*

Designed to help the hospital administrator resolve some practical problems relating to occupational health programs for hospital employees, this booklet attempts to answer questions concerning personnel, facilities and equipment, records, and costs.

Special sections are devoted to administrative relationships, services provided, and a list of references.

Diabetes Program Guide. *PHS Publication No. 506; revised 1960; 68 pages; 50 cents.*

Originally published in 1956, this guide has been used extensively by doctors, nurses, technicians, and administrators responsible for diabetes control in States and communities. It covers such topics as physiology of the disease; types of screening projects for diabetes detection; diagnostic standards, tests, and laboratory procedures; professional and community education; and other pertinent information.

Final results of the diabetes test validation studies replace preliminary data included in the first edition of the publication. Other text changes reflect newer thinking in diabetes management and detection.

Immunization Information for International Travel. *PHS Publication No. 384; revised 1960; 67 pages; 25 cents, \$18.75 per 100.*

Directed primarily to travelers going abroad, health departments, and physicians, this booklet gives current details on immunization requirements for persons entering the United States, including Americans returning from abroad, and lists requirements and recommendations for immunization in 200 other countries. A list of yellow fever vaccination centers and a special section on bringing pets into the United States is also included.

This edition supersedes the 1959 revision.

Local Health Organization and Staffing Within Metropolitan Areas. *PHS Publication No. 742; 1960; 184 pages; \$1.*

Data presented State by State show the organization and staffing of local health departments serving within the 189 standard metropolitan areas as defined September 1959 by the Bureau of the Budget.

In addition, the legal basis existing within each State under which jurisdictions may combine to provide local public health services is described. The data were compiled from reports made to the Public Health Service for specified periods in 1958 and fiscal year 1957.

This section carries announcements of new publications prepared by the Public Health Service and of selected publications prepared with Federal support.

Unless otherwise indicated, publications for which prices are quoted are for sale by the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C. Orders should be accompanied by cash, check, or money order and should fully identify the publication. Public Health Service publications which do not carry price quotations, as well as single sample copies of those for which prices are shown, can be obtained without charge from the Public Inquiries Branch, Office of Information, Public Health Service, Washington 25, D.C.

The Public Health Service does not supply publications other than its own.
